Pit and Quarry

SAND-GRAVEL-STONE
CEMENT-LIME-GYPSUM

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Pit and Quarry

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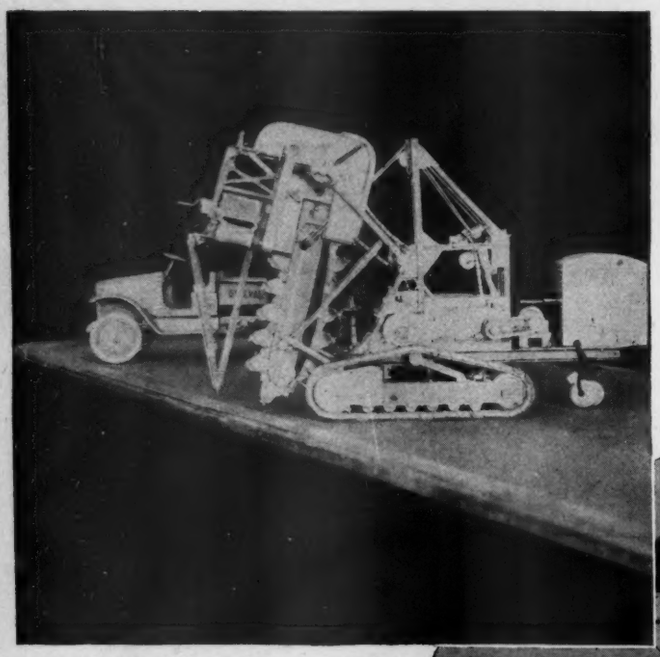
Let These B-G Juniors Show You How Barber-Greenes Earn Profits



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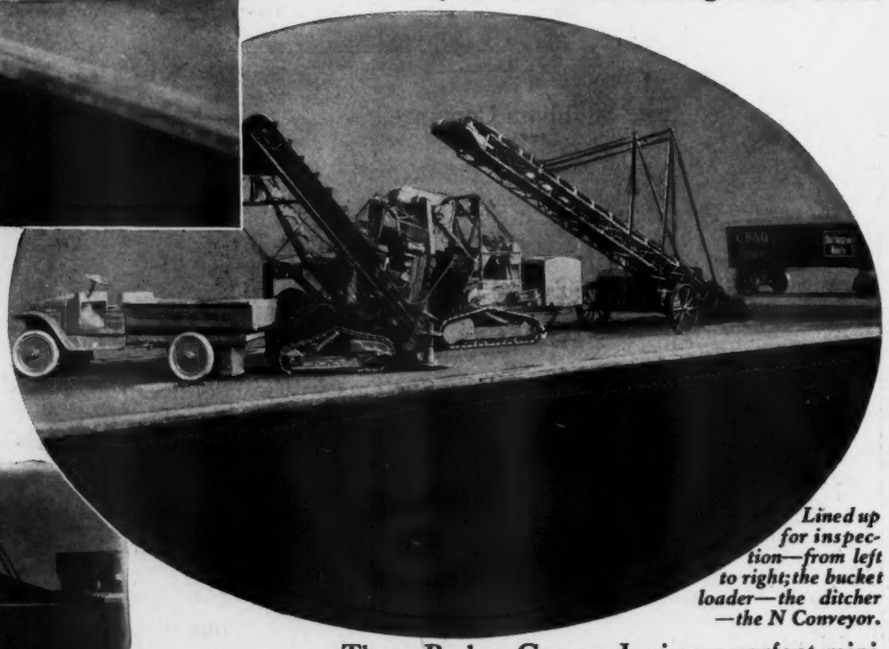

Lined up for inspection—from left to right; the bucket loader—the ditcher—the N Conveyor.

From car to storage to truck—B-G Juniors will demonstrate this job at the Road Show.

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Pit and Quarry

Vol. 13 CHICAGO, ILL., JANUARY 5, 1927 No. 7

FORECASTING BUSINESS CONDITIONS

SCIENCE is reduced to accurate and exact data; it is based on fundamental principles that are dependable and unchanging. The great laws of science have been determined after exhaustive study and research; they are sure. Until recently business has been a matter of guess work. The most successful business man was the best or the luckiest guesser. The pleasure in gambling, which is inherent in most men, gave a zest to the game. Most of us like to take a chance, to test our luck. So business men have groped their way through the varying vicissitudes of fortune, succeeding and failing apparently as chance decided. This aimless struggle generation after generation is being replaced by a more sound system of business enterprise. We are securing organized knowledge on the problem of making a living. Business experts have been studying prices, charts on wages, bank clearings, fluctuations in markets, in fact, all phases of economic business conditions. Seasons of prosperity decline, depression and improvement have been analyzed and forecast with remarkable accuracy. Conclusions which are of importance to business men are reached through the efforts of economists, statisticians, and business experts who attack the problem from all angles in order to arrive at sound scientific business economics.

Executives are alert for indications of change in business conditions and face the possibility of dealing with new and unusual problems each year. Management becomes increasingly convinced of the fact that major price movements are not accidental and the course of business is not entirely fortuitous. An undue degree of optimism may result in excessive business expansion, while pessimism may be accompanied by timidity or unwarranted caution. Badly balanced production may bring about a change in business conditions and may be called overproduction because the situation is not understood. Production for a future market is the problems of modern business. The market is estimated and a system of production created to provide for it. A study of that market and of the quantity of production required is the chief interest of management at the close of the year. The importance of comparative statistics is generally recognized especially when they deal with fundamental conditions. Foresight will often present undue changes which hurl the producer from a condition of being worked to death to one wherein he must rush madly about endeavoring to get enough orders to keep his plant running. If conditions are likely to be changing, we must keep one jump ahead and be ready to meet new situations with adequate preparation.

These changes in fundamental conditions are both wholesome and profitable if they are properly controlled. The essential point is to know what is about to take place in the industry and when the next change will occur. Few people can be tripped up if their eyes are open and they are aware of their surroundings. It is the blind, or absent minded man, or one who is too stupid to care who runs into a ditch.

Almost any review of opinions or expressions regarding future business will reveal the one outstanding characteristic: Confidence. Not only has the recent holiday trade, which paralleled if not exceeded all past records, provided both manufacturer and merchant with a goodly stock of conservative optimism, but those whose business it is to predetermine commercial trends are almost unanimous in the belief that throughout the first half of 1927 general trade can only be characterized as "good."

With one or two exceptions, notably lumber and agriculture, the sentiment of the business world seems well contained in the statement of C. H. Markham, chairman of the Illinois Central Railroad, which was: "The momentum attained by business in general during 1926 will serve to keep the channels of trade in a reasonable degree of activity during 1927, irrespective of minor disturbances which may develop." In spite of this expressed confidence, however, let us say that careful consideration and painstaking analysis of the various statistical indices makes possible nothing but the conviction that the volume of business during the first half of 1927 must show at least a moderate recession.

While the surface appearances of things would indicate that we are just now in the middle of an era of stabilized prosperity, it should be remembered that under this new order of things stabilization is not normal. Business is never static. A perfect, or nearly perfect, state of equilibrium cannot be long maintained now that, through engineering and science, varying businesses have become so interlocked and formerly "extraneous" industries have become so completely interdependent.

Our prosperity of the past two years or more

has had as its foundation: Easy money, an enormous volume of new building, a flourishing automotive industry, and the successful consummation of countless industrial mergers. Every influential factor seems to indicate that during the early part of 1927, short term money should be easier. Furthermore, with the advent of a moderate reaction in general business activity, short term money will probably continue in plentiful supply, at least throughout the second quarter of the new year. Thus it may be expected that this supporting element will remain in place and continue to exercise its influence in upholding the present level of production and trade.

During the past year construction has attained a degree of activity averaging 550 millions of dollars a month. This volume is a substantial increase over previous records, and this fact is interesting when coupled with the knowledge that any considerable rise in building volume is invariably followed by almost equally large recession. During the past four years the extreme activity in the building industry has been predicated on the shortage accumulated during the war period. But this shortage is now made up and over-building is becoming evident in certain localities. These conditions have resulted in a downward trend in rents, and in many sections new building is slowly declining. Because the prosperity phase of the construction industry is essentially a selling phase and largely dependent upon conditions in extraneous fields, further recession in building activity is reliably indicated. Indeed, the estimate of the building volume for the first six months of 1927 should place the average figure at a point not exceeding 500 millions of dollars a month.

In the automotive field the demand for motor cars is still strong and will doubtless so continue. The 1926 production of automotive equipment exceeded 1925 by 10 per cent in passenger cars and 8 per cent in motor trucks. Whether the industry will show a similar gain during 1927 is very much to be questioned, since competition has become extremely severe, production facilities are ahead of demand, and profit margins have been narrowed to the danger point. If the automotive industry is to continue in a state of prosperity there must be either a reduction in the number of expensive "new models," a drastic reduction in production costs (which seems unlikely) or the consummation of several mergers. This last, which would automatically effect the first two desired ends as well as effect a reduction in competition, seems eminent as a possibility for 1927.

The larger number of mergers effected during the past year is perhaps the most outstanding development in recent industrial history. The majority of these mergers were accompanied by either expansion or large replacement programs which activity contributed heavily to recent prosperity. While there will doubtless be a number of important mergers completed during 1927, it must be evident to all that the peak of combination activity has now passed so that this beneficial influence will be notably lessened as time advances.

Due largely to the development of high speed transportation, merchants and jobbers are carrying smaller inventories. This practice, styled by some as "hand-to-mouth" buying will in all probability continue and even develop to a more marked degree. One of the major factors contributing to its continuance, aside from the fact that when two days have been cut from the time necessary for the transmission of the order and two weeks from the shipping period for the merchandise dealers will naturally carry smaller stocks, is the progressive decline in commodity prices. It is impossible to over-look the fact that during the past year the commodity price level receeded more than 6 per cent. Doubtless a part of this decline can be explained by the excessive cotton crop and generally increased industrial efficiency, but even when due allowance is made, some of the decline remains to come out of profits. And there is no indication of an upturn in commodity prices during the first half of 1927.

On the brighter side of the picture, both employment and purchasing power remain at high levels, while car loadings indicate a large volume of goods steadily flowing into distribution. With respect to the latter barometer, however, it should not be forgotten that heavy car loadings are the natural concomitant of "hand-to-mouth" buying and that consideration of its importance as a barometer should fluctuate with the trend of events.

The sales prospect for the ensuing first quarter is favorable in the more populated districts, just fair over the larger portion of the country, and in certain localities considerably below average. Such a map as this, however, can be presented only tentatively, since marked difference in crop returns or seasonal curtailment or expension of industrial output may result in a fluctuation of the spotted areas.

In summary of the somewhat conflicting indications it must be said that general business conditions should show slight recession during the first half of 1927. This recession may be so gradual as to be almost impreceptible, but none the less, existing conditions do not warrant expansion at this time. While there are no important labor disputes on the calendar for the first quarter, the number of controversies will possibly show an increase after April 1. Outstanding among those industries which seem to be on the verge of marked recession are the building, automotive, and lumber industries. On the other hand we may look to the paper industry, transportation, steel, clothing and textiles to show sustained activity.

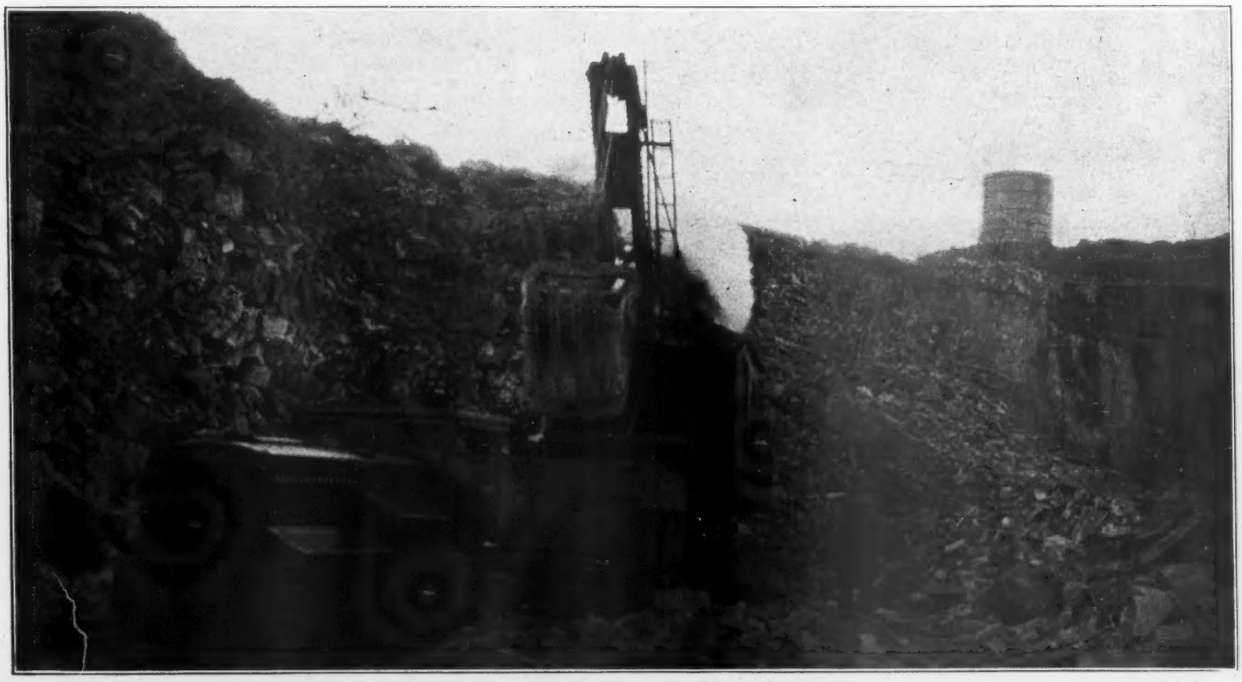
INDIVIDUALITY EXPRESSED IN THIS PLANT OF HARTFORD SAND AND STONE COMPANY

By F. A. Westbrook

WHILE it is an obvious fact that when a visit is made to a number of plants turning out the same products a good deal of similarity in machinery and processes will be found, there is always more or less a feeling of adventure connected with each plant that is visited because something unusual is almost sure to be found. No two operating conditions are ever exactly alike and no two operators ever have just the same way of handling their problems. The result is that a person can never tell what is in a plant or how it is managed until it is seen. Sometimes the interest in the unusual centers around a labor policy, sometimes around a combination of products or machinery, a particular piece of apparatus or any one of an almost unlimited number of possibilities as varied as the personalities of those responsible for the operation. There seems to be no rule as to what may be expected except that most of them show results of some kind and in many cases remarkably good ones.

Take for example the Hartford Sand and Stone Company of Hartford, Connecticut. This plant is managed by Mr. J. H. Cooke with the help of a carefully built up organization, some of the members of which have been connected with the company for many years. Mr. Cooke is also part owner of the Lynn Sand and Stone Company at Swampscott, Massachusetts, in the management

Inclines to the Primary Crusher



Shovels Loading Cars Drawn by Gasoline Engine at the Old Upper Level of the Quarry

Primary Jaw Crusher

of which he takes an active part. He has as assistant, Mr. Latham, who is superintendent of the Hartford properties and gives particular attention to sales. One delightful Indian Summer afternoon I went out to this company's trap rock quarry near the village of Farmington, Connecticut. At first sight it seemed just like any other trap rock operation but it soon showed that here was real individuality although it was necessary to look below the surface for some of the details.

The quarry is in a low ridge and apparently has been worked for quite a long time as almost the entire opening, which covers considerable ground, has been brought down to the level of the lower lying land. Just now a new opening is being made in the bottom which, as it spreads, will eventually lower the depth of the whole quarry. However, there is one corner which is still being worked from the old level so that stone is now being taken from two levels. A one yard Marion steam shovel is at work at each of these two points but as soon as the new opening is large enough for two shovels the one on the upper level will be removed to the lower level.

So far the drilling has been done with an Ingersoll-Rand piston drill but an X 71 Leyner has been recently purchased for this work. Air is supplied by an Ingersoll-Rand compressor, driven by a synchronous motor. This type of motor tends to correct the power factor and as the compressor runs practically all the time is the ideal type of motor for this operation.

Shovel Loading at New Lower Level. Note the incline to Primary Crusher. The old incline from the Upper Level is at the right.

Two Plymouth gasoline locomotives are in service, a four ton model which hauls cars from the shovel to the primary crusher, located at the foot of the incline, and a three and a half ton for similar service in the new pit. As will be seen from one of the illustrations there are separate inclines and hoisting engines from each level, but, as already mentioned, that from the upper level will soon be abandoned. The cars are hauled up from the lower level by means of an electrically operated Lidgerwood hoist through Roebling "Yellow Strand" wire rope.

Following the stone as it comes from the lower level, it is first dumped from the quarry cars, which are home made, into a 30x42 inch Buchanan jaw crusher. This is also driven by a synchronous motor which is good practice from the viewpoint of power factor correction because of the great variations of load to which the motor is subjected. Sometimes the motor is idling which would be particularly bad for the power factor, because then the machine would be greatly over-motorized, if an induction motor were used. From the primary crusher the stone is taken by a 42 inch elevator to a No. 7½ Gates gyratory crusher and then by a 30 inch elevator to a revolving, scalping screen, five feet in diameter by twelve feet long. The oversizes from this screen drop into a No. 4 McCully gyratory crusher from which the recrushed stone goes back on the same 30 inch elevator, already mentioned, to the scalping screen, which has two and a quarter inch openings. The material which passes through these openings is taken by a 24 inch elevator to the sizing screens.

Elevator to Sand Bin and Loading Station for Trucks

Two of these are provided with their axes at right angles, and are jacketed.

The first screen has one inch openings in the

Excavating at the Bank and Loading Sand Cars

Hoist for New Incline

View of Plant Showing End of Incline from Lower Level

jacket and one and three-quarter inch openings in the inner section. It thus separates the one inch and two inch sizes, dropping them into their respective bins and permits the sizes under one inch to pass through the jacket into the second screen. In this screen the jacket has quarter inch openings and the inner cylinder five eighth inch holes so that this screen separates the half inch and three-quarter inch sizes. The dust passes through the screen. All three grades are dropped into separate bins.

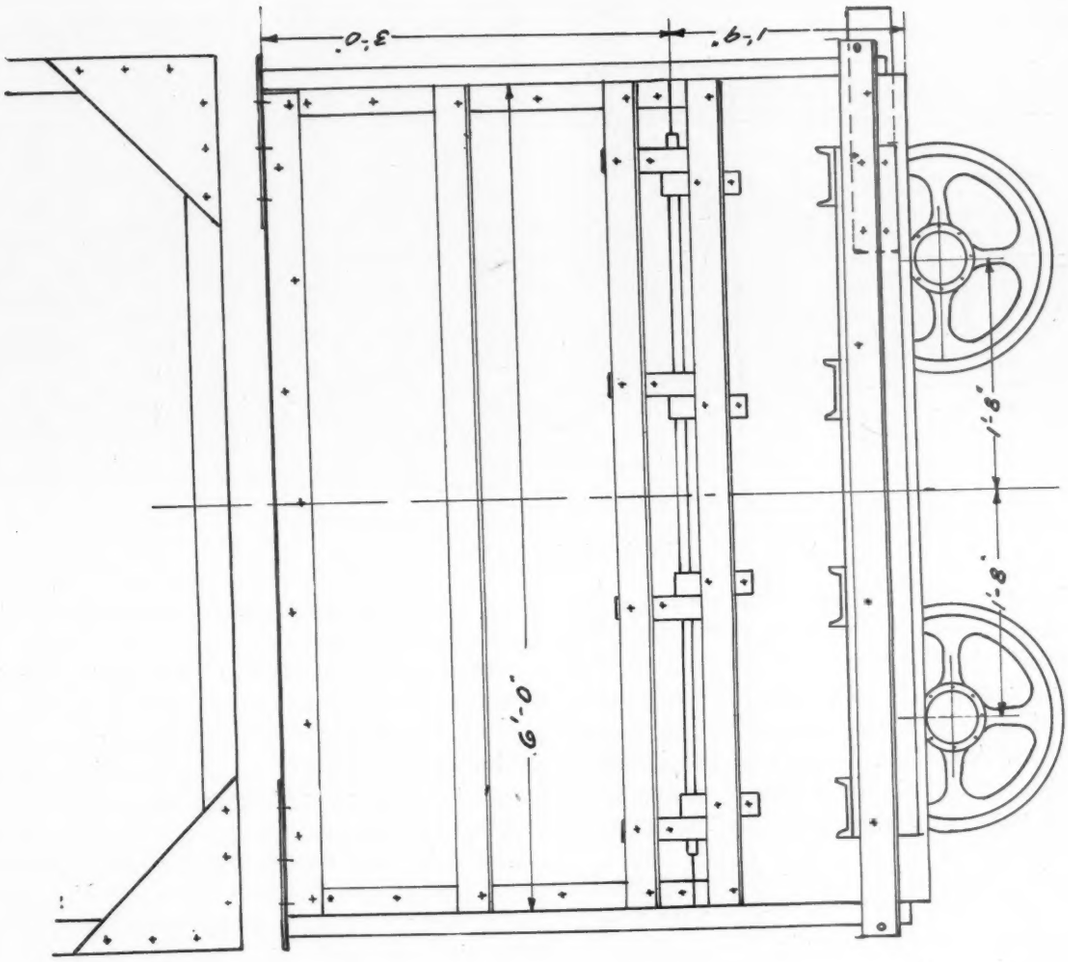
Secondary Crusher and Elevator

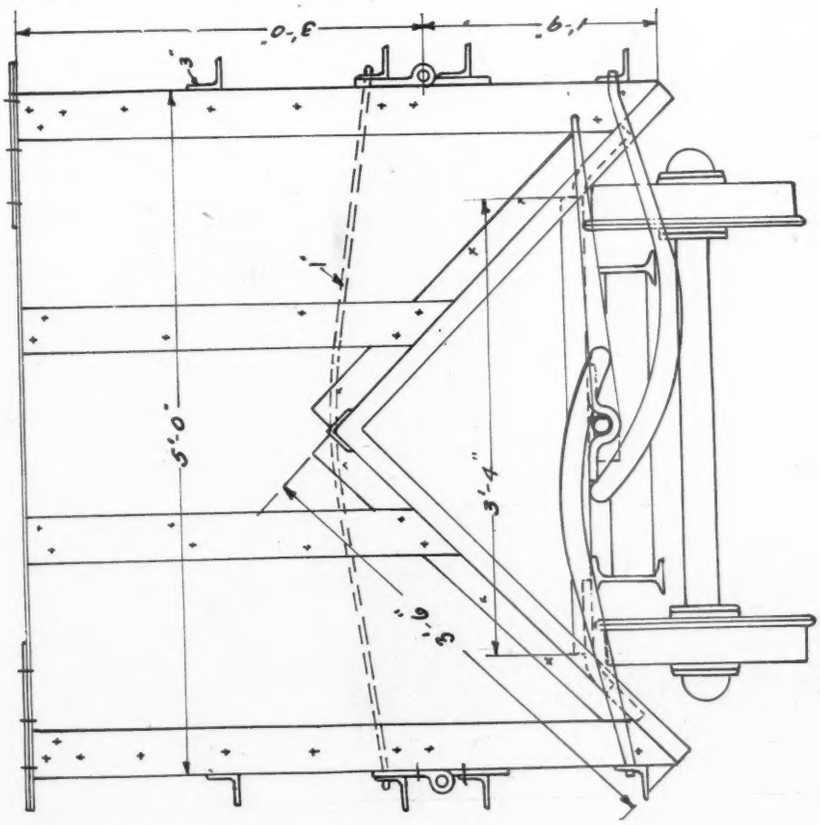
Sometimes the plant has a surplus of two inch stone when more of the smaller sizes are needed. To meet this condition a Symons disc crusher has been installed which is fed by a chute from the two inch stone bin and discharges through another chute into the scalping screen where the material is separated as described.

This arrangement describes the flow of material as it comes from the lower level. Temporarily, the stone from the upper level, coming up the old incline, is dumped into the No. 7½ Gates gyratory crusher and then follows through the various machines. However, this arrangement will only be until the steam shovel is removed from the old upper level. The jaw crusher and the two gyratory crushers are arranged in a straight line and over them is a runway for a ten ton Armington traveling crane which is used both for maintenance work and for dislodging large pieces of stone which from time to time bridge over and block the crushers.

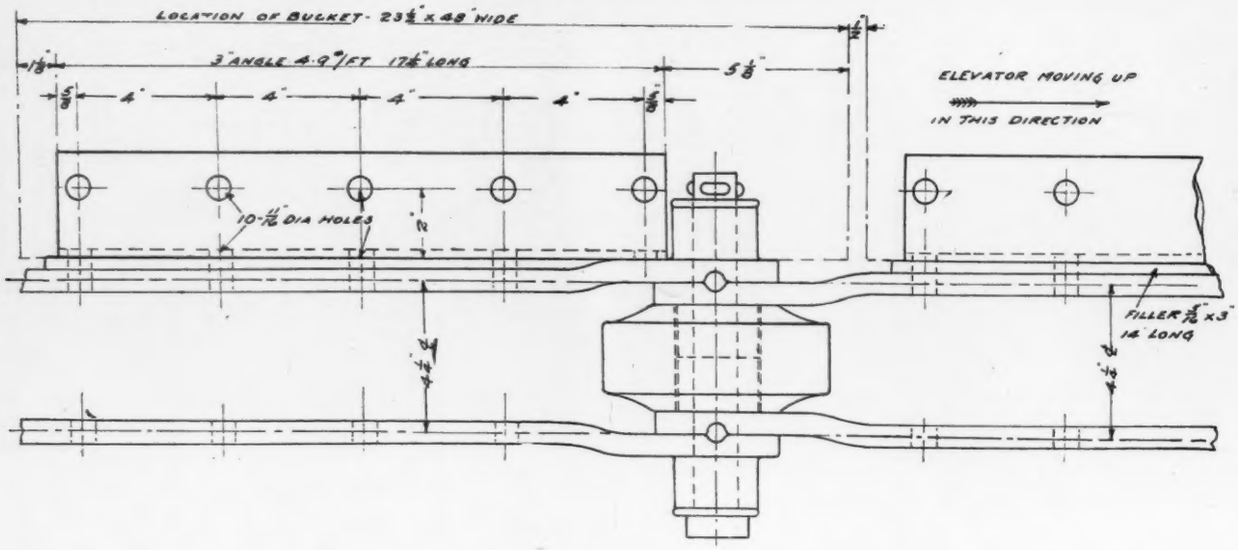
Mr. Cooke has very definite ideas in regard to screens and elevators, and has designed some of those used at the plant. In fact he believes in devising most of his plant machinery, in so far as practicable, because he feels that this is the best way to meet the requirements of the particular local conditions. As a general thing he prefers elevators to belt conveyors because this gives a more compact plant. One of the illustrations shows the design of these elevator chain links.

The elevator chain is composed of one style of link which may be used in any of the four positions in which it might be desired to place it. When the hubs are turned inward they form a bearing for the rollers which run in three inch channel iron, supporting the chain. Angle irons are bolted to the links and the buckets, usually obtained from Hendricks, are bolted to the angles. The angle irons may be readily attached to the links in what-





Details of Special Dump Car



Details of Elevator Chain

ever position they may come. The buckets are set four inches ahead of the centers of the chain to facilitate the discharge of the material at the head of the elevator. These links are purchased from either the Frog Switch and Manufacturing Company or the American Manganese Steel Forge Company. The sprockets are made of manganese steel and are also purchased from the Manganese Steel Forge Company.

An 18 inch pitch chain is used for a 24 or 30 inch bucket, a 21 inch pitch for buckets up to 42 inches and a 24 inch pitch chain for a 48 inch bucket, which latter will take care of a 48x60 inch jaw crusher. This type of elevator has been in use for seven years in a place where a rubber belt would hardly last a season.

The screens are usually built by the blacksmith at the location of the quarry, and are of the center shaft type, the shaft being about 16 feet long, supported by a bearing at each end, which are in turn supported by an "I" beam frame. This shaft carries two manganese steel rings supported by arms which are keyed to the shaft. These rings form the outside diameter and ends of the screens. There are "T" bars connecting these rings which support the perforated screen sections. The screening surfaces are 12 feet long and of different diameters as the work and capacity of the screen

Dump Car Moving Load of Sand

Scalping Screen and One of Elevators

Traveling Crane Installed Over the Crushers

may require. The perforations in the scalping screen produce the maximum size of stone, the rejections being carried to a secondary crusher, and returned by the same elevator to the scalping screen. The product passing perforations in this scalping screen is carried by a second elevator to the sizing screens in the plant as previously described. It is the policy of this company to have these screens equipped with only one size of hole in each cylinder. Whenever two sizes of product are to be separated by one unit the second size is accomplished by a jacket which is 18 inches larger diameter than the main screen. This jacket is supported by rings at each end connected by "T" bars which hold the steel perforations in place, the general idea being to use more units and not attempt to make all sizes of stone with one unit.

The question of water is of importance at this plant, and the supply is obtained locally during most of the year. Of course, it is frequently necessary to get rid of surplus water. For this purpose two, five hundred gallon Goulds centrifugal pumps are provided at the pit.

The output of this operation is from 550 to 600 tons per day. Although it is located directly adjacent to a trolley line very little material is shipped by this medium. This method was used to a greater extent, formerly, but the distance to Hartford, where a good deal of the crushed stone is delivered, is not great so that it is deemed preferable to have only one handling and therefore make deliveries by truck. Furthermore much of the stone is used for road construction which could not be reached by trolley. For this purpose, twelve trucks, eleven Mack and one Pierce-Arrow are used. A Buffalo scale is located alongside the office building for weighing the outgoing loads.

Sand Plant Operation

In addition to the trap rock quarry and crushing plant, Mr. Cooke has a large sand bank at East Hartford. This sand is shipped almost entirely by truck because of the fact that it is used at certain definite points to which it can be most economically delivered in this way. The bank is located close to the Connecticut River and is of such uniform grade that screening or washing is unnecessary. A large storage bin is located over a spur from the trolley line and the cars are run underneath and loaded for deliveries made by trolley cars.

The procedure at this point is interesting. The loaded cars from the sand bank are brought up to the side of the bins and simply dump their loads from a trestle. An elevator extending from under this pile carries the sand up to the top of the bins. As shown in one of the illustrations there is also a bridge under which trucks may be loaded.

Sand is excavated at the bank by means of a Marion steam shovel, model 21, into cars designed to hold about five yards. Two 4 ton Plymouth gasoline locomotives take these cars to the storage bins. The locomotives handle only one car at a time as there is a grade of about 4 per cent at one section of the route. About midway between the shovel and the bin is provided a turnout to enable the cars to pass each other. The production is about three hundred tons per day.

The cars used here are of an unusual design for which Mr. Cooke is responsible. This design is illustrated in this article. The cars have a chicken-coop bottom and a door on each side which is opened by one lever. The doors are automatically locked when the lever is in a horizontal position, each end of a door being connected to a shaft running the length of the car. With this design it is readily seen that the load can be very quickly discharged. These cars are admirably adapted to the conditions existing here where unloading is from a trestle and where it is desired to distribute the sand evenly on both sides. It will thus be seen that the operations of the Hartford Sand and Stone Company have their share of individuality and that they most decidedly reflect the personality of their owner.

NO LOST TIME ACCIDENTS FOR 500 DAYS

LEE A. GARDINER presented the following interesting and timely article in National Safety News for January, which is well worth reading.

"It can't be done," said the skeptics.

"We can if we will" shouted back one of the sign boards posted along the driveway quoting those memorable words of Theodore Roosevelt.

And the interesting part is that it was done and the Genoa Lime Plant of the U. S. Gypsum Company, has operated over 500 days without a lost time accident and today ranks with the leaders in quarry safety.

Quarrying, according to the statistics outlined by Industrial Commissions of various states, is one of the most hazardous of occupations. Falls of rock, falls from piles of rock, large blasting operations, haulage and hoisting equipment, and many other hazards confront the quarry worker every minute of the day. Is it strange that in a quarry covering several acres of ground and worked to a depth of 80 to 90 feet that accidents were very common before organized accident prevention work was undertaken?

Prior to 1925 the quarry had always suffered the heaviest, having nearly twice as many accidents as all the other departments put together. But when the year 1925 ended a silver loving cup denoting the departmental winner was awarded to the quarry. Only one lost time accident was marked up against the quarry. This accident occurred on the night shift when it was necessary for quarry workers to work by large flood lights situated on the bank at various points. This one accident caused 40 hours lost time. So far during 1926 no accidents have occurred in this quarry.

Three drills are working all the time along the bank making holes for large charges of dynamite. These big shots bring down many hundreds of tons of limestone, some of the pieces being larger than a house. These pieces are then broken up by pop-shots at intervals during the day. A shelter house is provided to protect quarry workers during blast-operations. After the rock has been broken up by dynamite the chunks that are too large to be handled easily are broken by sledges and then loaded by hand into cars which hold about one and a quarter tons.

These cars are hauled across the quarry by mules to the place where they are to be hoisted. Three enormous gantry cranes then hoist the buckets, or cars, over a hundred feet in the air where the rock is dumped into kilns to be burned. The cars are then lowered and returned via mule power to the workers at the face. The hand labor involved makes this work especially hazardous.

A safety engineer was sent to this plant on October 15, 1924, to take charge of the work of accident prevention. Ever since this time the plant has employed a full-time safety engineer. A work sheet was made out at once outlining the year's activities in advance listing new events monthly which would keep up interest and cut down accidents.

Among the schemes devised for maintaining interest was a safety show. It was planned to hold this show one night in the town hall, the seating capacity of which was about 600 persons. About 20 men took part in the acts appearing in this show, working hard and faithfully to make it a success.

As the night of the show approached the embryo actors were a little bit nervous about appearing before the crowd as some had intimated that a barrage might be started from the back seat and aimed in a general direction of the stage. Although free tickets were issued to every workman and his family the safety engineer and the superintendent wondered and possibly worried a little over the fact that a show devoted entirely to safety had never been tried in Genoa and there was a possibility that no one would come to see it.

Imagine, then, their surprise when the crowds started filing into the town hall two hours before the time the curtain was to rise. A full half hour before starting time it was discovered that every seat in the house was filled and that many people were standing up in the rear of the hall. The number of people made it necessary to repeat the following evening. The house was packed again on the second showing.

Included in the program were a motion picture obtained from the National Safety Council, a speaker on safety, Jay E. Thompson, secretary of the Toledo Safety Council, a safety play similar to those put on at the General Round Table at the Fifteenth Annual Congress held in Detroit, and a cowboy roping and monologue act, imitating Will Rogers, by Dave Hite who had been acting as assistant to the safety engineer and "knew his groceries" when it came to presenting safety before an audience of workmen.

At one time as a point of interest in the safety plan three dummy figures of men were leaned up against the employment office and labeled "Accident," "Thoughtlessness," and "Horseplay." It was intended that one of these figures would be awarded to any department having a lost time accident, but fortunately this was not necessary and the figures gradually became dilapidated from exposure to the weather. They were finally buried with appropriate ceremeonies.

At another time a mound was made in front of the employment office to resemble a grave and a

Continued on page 110

INSTALLATION AND CARE OF BELT CONVEYORS

By William E. Phillips*

THIS subject is one upon which volumes can be written, and so broad, and the temptation to deal in generalities so great, that if we are to get something tangible, something concrete, out of this paper, with your permission I would like to confine my remarks to practical items of importance. The use of belt conveyors is hardly more than 45 years old. For 20 years of that time, the writer has been active in it—designing, building in the shop and, in the field, supervising the erection and operation of belt conveyor equipment; and has acquired valuable experience in dealing with suggestions and complaints from you boys who use belt conveyors and co-operating with you in improvements in design from time to time.

The practical superintendent or mechanical engineer, when considering his conveyor problems, first asks, "Will a belt conveyor do the work?" The belt conveyor, with its wide range of service, everything considered, offers the most economical method of handling all bulk and package material.

Handling large quantities of material at low cost is the work to which the belt conveyor is admirably suited. Its large capacity, due to its continuous delivery of material at a relatively fast speed, and its low power consumption, makes for a low handling cost per ton.

To take the utmost advantage of the possibilities that the belt conveyor offers, four things are required:

1. Low coefficient of friction with its attendant low power consumption.
2. Long belt life.
3. Low rate of depreciation—and
4. Low maintenance cost.

Depreciation and maintenance can be kept down by the use of high grade equipment. The other essentials to economical service—belt protection and low power consumption—are controlled largely by the character of the idlers, which constitute the road bed on which the belt travels. The service given by the conveyor depends, therefore, on the construction of the idlers, and it is upon this that we must focus particular attention.

Idlers

Special study must naturally be given to the moving element of the idlers.

Bearings

Just as any structure to be secure must rest upon a firm base, so a successful conveyor idler must be built upon a substantial bearing. The efficiency of the bearings, more than any one thing, determines the service given by the conveyor. Belt conveyor service demands a bearing that will carry heavy loads. Due to loading conditions, weaving of belt and many others, about 15 or 20 per cent of the load is thrust, and 80 or 85 per cent radial, a double purpose bearing is necessary to meet these requirements.

The Roll

Since the roll is the key to the successful operation of the idlers, and so of the entire belt conveyor, this unit is of vital importance. The roll shell must be built for strength and rigidity, light in weight, true running, and have smooth rounded edges that can not injure the belt. The roll hub must be machined to secure concentricity of the hub, with respect to the roll shell, to obtain perfect alignment of the bearings and concentricity of the assembled roll, with respect to the shaft.

In order to have proper functioning of bearings and, consequently, the entire idler, good workmanship with close working tolerances are features of importance. Many times, the best bearings are greatly shortened in life by improper mounting and poor workmanship. Our company has found, by experience and tests, that the best workmanship and good mounting designs are of vital importance and give long life with practically no attention.

Grease Seal

Bearings should be protected by grease seals, not by felt washers or packing, which defeat the purpose of anti-friction bearings. Grease seals are practically frictionless. Lubricant should be applied under pressure to the inside of roll, causing it to flow outward through the bearings, thus serving to carry away any dirt or grit which might have worked in.

Assembly of the Idler

The idler rolls should conform to the general troughed shape of the belt. Brackets should be so constructed as to support the ends of the rolls, thus maintaining perfect alignment of the rolls. Roll shafts should be supported as close to the roll as possible, without over-hang, so there are no high bearing moments in the shaft.

Base of Support

The roll support should present a rigid support for the idler with a self-cleaning base, accurate and uniform spacing of rolls, an important feature in the proper training of a conveyor belt, and one which makes unnecessary the use of objectional guide idlers.

Return Rollers

Return rollers are as important a factor in reducing cost of conveying materials by belts, as

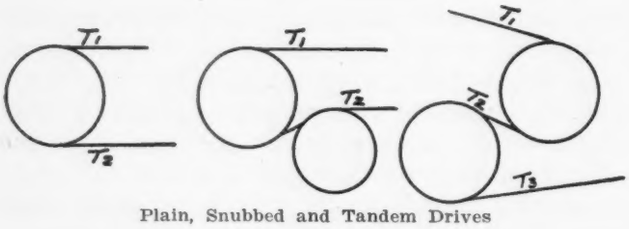
*Paper delivered at the Eighth Annual Meeting of the Wisconsin Mineral Aggregate Association, Milwaukee, December 16, 1926.

the carrying rolls; and the same general design and construction as the troughing rolls should be carried out.

Belt Conveyor Drives

The design and selection of the correct type of drive is just as important in a belt conveyor installation as the choice of the idler, as both determine its efficiency and the number of plies or thickness of conveyor belt necessary to transmit the belt tension or pull required to drive the conveyor.

There are three general types of drives in common use, as follows:



Plain, Snubbed and Tandem Drives

TABLE D

E Effective HP Pull $= \frac{\text{HP} \times 33000}{\text{Belt Speed}}$

Degree of Belt Contact	Type of Drive	Value of T_1 Bare Pulley	Value of T_1 Lagged Pulley	Ratio of T_1/T_2 Bare Pulley	Ratio of T_1/T_2 Lagged Pulley
180	Plain	1.85E	1.50E	2.19	3.00
200	Snubbed	1.72E	1.42E	2.39	3.39
210	Snubbed	1.67E	1.38E	2.50	3.61
220	Snubbed	1.62E	1.35E	2.61	3.83
240	Snubbed	1.54E	1.30E	2.85	4.33
360	Tandem	1.26E	1.13E	4.80	9.02
420	Tandem	1.19E	1.08E	6.25	13.00
500	Tandem	1.13E	1.05E	8.86	21.21

The above table shows the advantage of snubbing and lagging the drive pulley. A belt whose working tension is 2400 lbs., running over a bare pulley with 180 degrees of belt contact, will develop $\frac{2400}{1.85}$ =1300 lbs. of effective pull to move the load. With a lagged pulley, snubbed to secure 220 degrees of belt contact, the belt would develop $\frac{2400}{1.35}$ =1800 lbs. of effective pull. At a belt speed of 300 feet per minute, this amounts to 4.5 additional effective horsepower, which this belt would develop by the lagging of the drive pulley and the addition of a snub, without changing the working tension of the belt.

From the above information, the working belt tension can be calculated for a given horsepower. The type of drive, of course, depends on the horsepower to be developed, and the belt stress should be kept within the limits found from experience and tests to be advisable.

Belt working stresses vary according to different belt authorities. The following, however, we believe to be good practice:

28 oz. duck
20-24 lbs. per ply inch
32 oz. duck
24-27 lbs. per ply inch
36 oz. duck
30 lbs. per ply inch

} Depending on material handled, loading condition, conditions of service, etc.

Snub pulleys are usually used on heavier drives with large pulleys and considerable slack tension, in order to relieve the first return roller of overload, even though unnecessary for belt contact.

Hugger Drive

For heavy drives, in order to develop the largest possible effective horsepower pull in the belt, the ratio between the working belt tension and the slack tension must be high. Since this ratio depends on the angle of belt contact on the pulley and the co-efficient of friction between the belt and the pulley, the increase of this ratio is ordinarily accomplished by the use of tandem drive pulleys to increase the belt contact and by the lagging of the pulleys to increase the co-efficient of friction between the belt and pulley.

The hugger drive is a more efficient means for accomplishing the same result, and makes it possible to get even higher ratios between the working tension and the slack tension than is possible with the tandem pulley type. It secures the necessary added grip on the drive pulley by means of a pressure belt, which presses the conveyor belt hard against the drive pulley, and which is regulated by the initial tension put into the pressure belt by counterweights. The "hugger belt" accomplishes this without involving the destructive effect (on the conveyor belt) of the slip that is inherent in multiple pulley drives. With the "hugger" drive and the use of a single drive pulley, the driving contact between belt and pulley is confined to the clean side of the belt.

The use of a single drive pulley eliminates the possibility of a speed differential between the two pulleys of a tandem drive, due to slight inequalities in the diameter of the drive pulleys, or the material building up on the pulley in contact with the dirty or carrying side of the belt. By proper regulation of the counterweight mechanism in the pressure belt, the conveyor belt can be adjusted to the correct tension to pull the load without changing the takeup tension of the conveyor. The ratio of the working tension T-1 to the slack tension T-2 can be brought up to 20 and more, depending on the arc of contact of pressure belt on conveyor belt, and size of counterweight in pressure belt. This ratio can always be made higher than for a lagged pulley tandem drive, so that, in case of very heavy drives, the working tension of belt can be made practically the same as the horsepower pull of the belt.

The nature of work performed by belt conveyors makes it evident that two equipments are seldom,

if ever, exactly alike. In order, therefore, to secure the best possible results, it is necessary to consider each installation as an individual problem and select the equipment that is exactly suited for that particular work.

Takeups

There are two general types; screw takeups and weighted takeups. The screw takeup is simple and cheap, but it is not certain to maintain the proper tension on the belt. A pull back weight applied to the foot shaft, or a weighted pulley, acting on the return run of the belt, is certain in its operation and will give best results.

Belts

After the selection of the proper idlers and drives, the most important factor in connection with the conveyor system is the belt, for, after being put in operation, it is the part that receives nearly all the wear and tear. Consequently, the belt should have the most careful consideration, so that it will be properly specified and selected for the particular work it must do. Probably the automobile industry, with the fast development of tires, has made it possible to develop a belt which can withstand this severe service which is imposed upon it. The improvements made from time to time in rubber conveyor belts have kept pace with automobile tire construction. Today the rubber cover on a conveyor belt is practically the same material as used for treads on automobile tires.

In the purchase of belts, it is the writer's opinion that as many belt failures are caused by overplying as underplying, and a great deal of horsepower wasted by the overplying of belts. To obtain the best service, a belt must be strong enough to pull the load without stretching, yet flexible as possible to trough easily. About 80% of the life is taken out of the belt before the cover wears through, and only 20% thereafter. Care should be given to proper cover thickness, considering the kind of material handled and method of handling.

Care of Belt Conveyors

Cleanliness is next to godliness, and is indeed an essential item in the care of belt conveyor equipment and belts, and the cost of this important item will pay dividends in long life, low maintenance expense and greater tonnage. Avoid the use of guide idlers—train your belt with troughing idlers. No guide idler ever did anything better than ruin a belt—you can not guide a belt with them. Don't let dirt accumulate on rims of pulleys, on decking, or under idler rolls or return rollers. Don't run the belt too tight. It will be less subject to wear and cutting if moderate tension is applied; only enough to pull the load without slip on the drive pulley. Inspect at regular intervals to see that belt does not rub against chutes, skirtboards, tripper frames or any fixed member of the supporting frame or housing.

Repair cuts in belts if the fabric is cut. Use fasteners to hold the edges together and prevent the cut from spreading. If the cover is cut, clean out the dirt, roughen the edges with sandpaper, apply several coats of rubber cement (letting each one dry before applying the next); then fill the hole with tire putty or tire gum, which is sold for repairing automobile tires. If the cover is torn away, protect the exposed duck by several coats of rubber cement, or else cut out that section of the belt.

Prevent oil or grease from getting on belt. They soften the rubber and kill its elasticity. Good equipment deserves good care. Inspect and examine it regularly. Repair every small evidence of wear; don't let it become serious; thus avoiding shutdowns and loss of operating hours, thereby greatly prolonging the life of the equipment. Belt life can easily be greatly reduced by incorrect feeding device, or by failure to keep in order a device that was originally correct. Ideal feeding conditions are to feed material to the center of the belt at a velocity equal to that of the belt itself and in the direction of its travel. If possible, a layer of fine screenings should be placed on the belt before the larger pieces strike it. This layer of fine material cushions the impact of the larger lumps and thus reduces the wear on the cover.

Skirt Boards

Skirt boards are used at the loading points to prevent spilling of the material over the edges of the belt. The bottom edges of the skirt boards should clear the belt, so that the belt and boards can not come in contact, and so that no material can spill through the openings. An extension can be made of strips of rubber, not belt, which should also clear the belt. If this rubber strip is allowed to drag on the conveyor, it will naturally cause abrasion.

Belt Joints

There are many types of belt fasteners, and great care is necessary in their selection. This is a subject I am sure can only be considered on each installation and can not be a general subject. While belt conveyors have been used for many years, the most rapid development has been made in the last ten years. Today we find that belt conveyors are dependable in their operation; positive in their performance; not entirely dependent upon the human element; more durable than most machines; require few men to operate; low in first cost, and have low operating expense. Last, I would like to call your attention to a new development in the art of belt conveyors, known as the Duplex System.

Duplex System

The Duplex System consists of a power transmission belt and a separate wear sheet, the former

traveling over the regular head and tail pulleys, and the wear sheet conveyed by frictional contact with the transmission belt, and kept in alignment with the transmission belt by the use of separate idler pulleys, located in front of the head and tail pulleys. The tonnage delivered by the wear sheet will exceed tonnage carried on regular covers of equal thickness, owing to the fact that the discharge of load is over small diameter idler head pulleys, instead of large diameter head pulleys. In addition, the wearing sheet rubber is never under any tension and, therefore, resists abrasion to a greater extent.

Wear sheet cost is approximately one-half the cost of a regular conveyor belt of equal thickness of cover. The wear sheet can be replaced without the necessity of renewing the power belt. Since the wear of a conveyor belt is practically confined to the cover, it is readily apparent that a great saving in belt maintenance can be effected by the use of this type of belt.

The Duplex System is especially adapted to short conveyors which impose a heavy duty on the surface of the belt, due to passing so frequently under the loading chute. In fact, any conveyor which is subject to hard duty, due to the extreme surface belt wear from sharp or abrasive material, would probably show considerable saving in the use of this type of belt.

There are many other points of advantage about this system, which indicate that it has possibilities of operating economy, which should appeal to the man who is interested in low tonnage costs for handling material. The belt conveyor, as a whole, is so filled with opportunity for profit to the operator, when correctly and wisely designed, installed and maintained, that its use is absolutely essential to modern methods of material handling.

Review of Power Exposition

The Fifth National Exposition of Power and Mechanical Engineering was a tremendous success. It registered strides of progress throughout the entire field of the design of all types of mechanical equipment. In diversity of exhibit and in quality of equipment shown, the Show was a great improvement over the four previous events. A large section of the exposition was given over to the presentation of heating and ventilating equipment which has advanced greatly in recent years. During the week of December 6 through 11, the Grand Central Palace was open daily from noon until 10:30 P. M. One hundred thousand visitors came to study the exhibits displayed by four hundred and ninety manufacturing firms on four floors of the building.

An exposition of this character exerts a tremendous educational influence and the management of the Show encouraged it by securing from those who were interested in problems of mechanical design some novelties for the interest of the Show's visitors. The exhibits were amplified by means of an interesting program of moving pictures of mechanical devices that could not readily be reproduced in action in the show itself.

In the field of power generation the Exposition drew many novelties in the design of boilers, in the development of refractories, in the adaption of valves and fittings for high pressure operation, in the provision of several new methods of control for boiler plant operation, and in the development of new measuring devices.

Manufacturers of refractories displayed new designs and new materials with which they are contesting the trend toward metal casings for combustion chambers. Special shapes of refractories for air-cooling and water-cooling, and special provisions for quick replacement and repair of refractories were shown.

Pulverized fuel is holding its place in the attention of power engineers and the progress in the art of using it economically was revealed by the large number of turbulent burners and unit pulverizers shown. The possibilities of using superheated steam were brought out by many manufacturers who showed how the superheated elements could be combined in many different ways with existing boiler designs.

In the field of control there were several interesting exhibits. One adapted an electrical method of varying the fuel and air supply in proportion to a direct current which was, in turn, varied by the steam pressure. A sensitive excess feed water pressure regulator was shown as was a new universal type of control suitable for adapting to regulate temperature, pressure draft, water flow, air flow, etc.

The part that measuring devices play in power plant operation was impressed upon the visitor by over thirty exhibits of devices for measuring and recording the operating factors in all types of plants.

Other equipment of interest to power plant operators was a complete service of diagrams of condensers, air motors, air filters, pumps to operate against high pressures and stokers. In addition there were electric gas analyzers, electrically-operated safety valves, and two types of ventilated motors for operating in a dust-laden atmosphere.

In the field of power transmission there was an impressive array of exhibits of ball bearing manufacturers, of reduction gears and all types of bearings and belting. Other classes of exhibits which should be mentioned are machine tools, shop equipment, coal handling and ash handling devices, conveying machinery, illuminating equipment for factories and power houses, and packings. The plans are already under way for the holding of the Sixth Power Show from December 5 through 10, 1927.

SAND AND GRAVEL NEIGHBORS COMPARED

By George Ransom

THE metropolitan area of New Jersey presents a very active market for crushed stone, sand and gravel on account of the large amount of building and road construction work being carried on in the vicinity. A group of several operations for supplying these materials is located near Little Falls, New Jersey, which is centrally located with respect to Montclair, Newark, Passaic and Paterson. This section is undergoing a rapid and sustained suburban development, with a corresponding business for those connected with construction work.

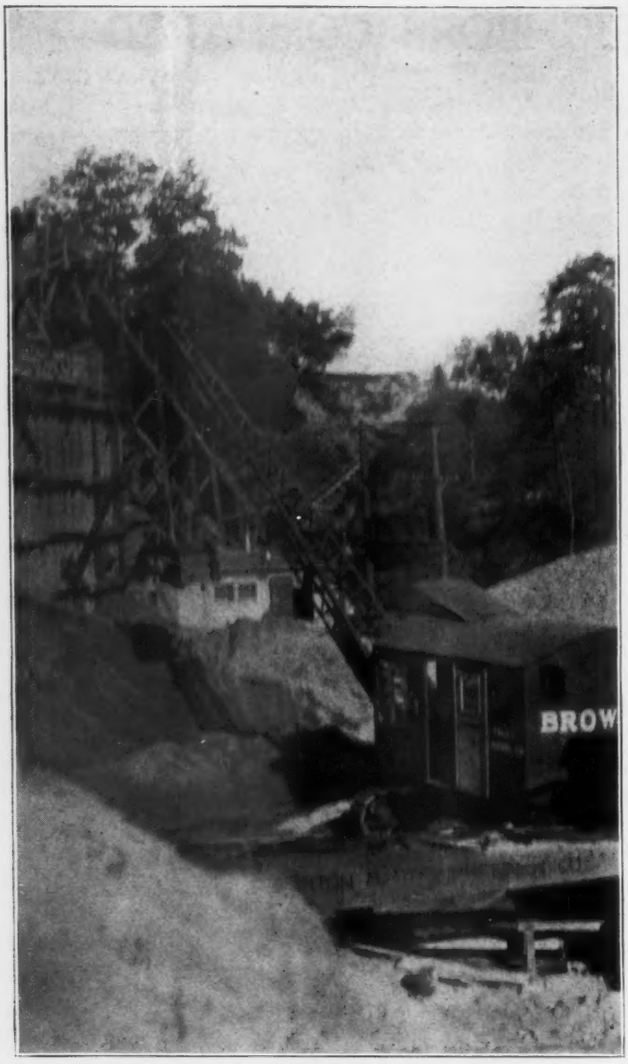
Among this group of operators is the Little Falls Sand and Gravel Company. This company owns about 15 acres of a very excellent deposit of sand and gravel, which is being worked by a decidedly up-to-date and apparently efficient installation of machinery. The plant was installed by the Link Belt Company, although the Earl C. Bacon Engineering Company supervised the installation of the Jeffrey elevator.

The gravel bank which is now being worked is so hard that it does not cave easily with the action of a drag line scraper. Consequently it is necessary to blast the bank. This is done by shovelling a horizontal hole about twelve feet long in a stratum of fine sand, which has good holding power. From ten to thirty sticks of 60 per cent Hercules dynamite are used for each blast.

For excavating, a two yard Green drag line scraper is used, operated by a two speed Thomas

Conveyor Up Incline to Screens. Little Falls

General View of the Plant. Little Falls



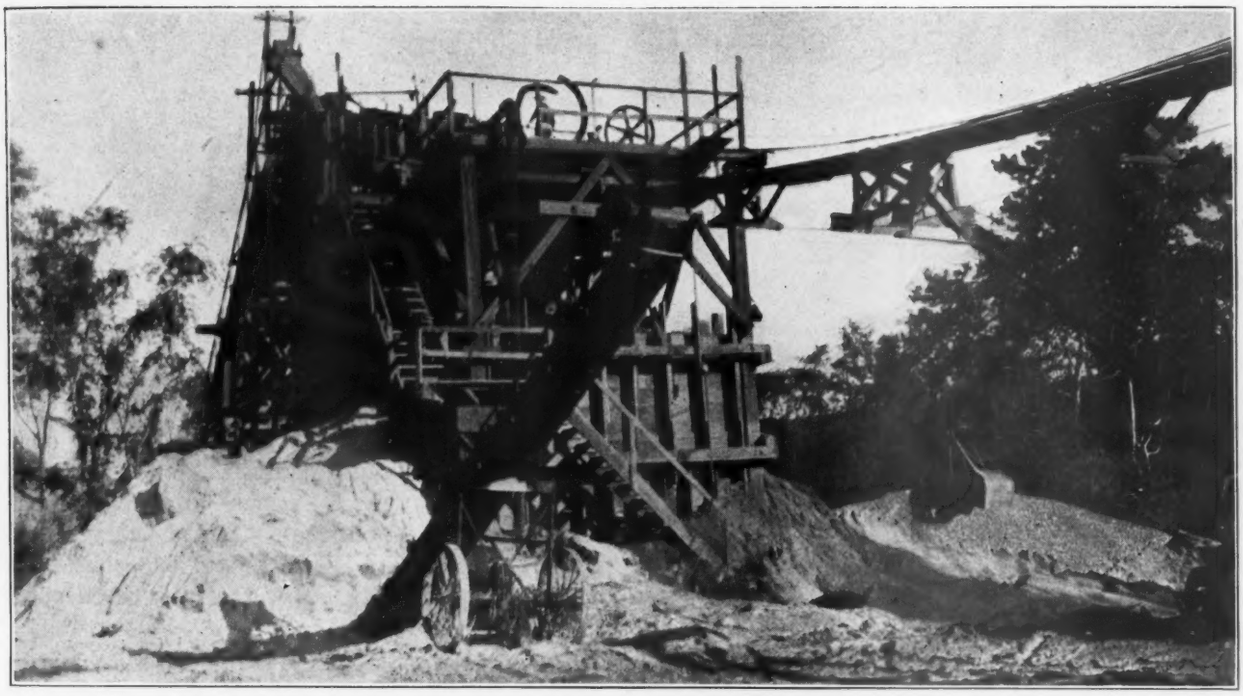
Crawler Crane Loading from Sand Piles. Little Falls

Drag Line Scraper Delivering a Load at the Grizzly. Little Falls

hoist driven by a 90 H. P. General Electric Company induction motor. This scraper brings the material to the grizzly, located over a receiving bin. The large sized cobbles slip off the grizzly and drop into a Koppel side dump car. This car is then pushed by hand down a slight grade to the waste dumps. Leschen red strand wire rope is used for the scraper and for all other equipment where wire rope is used in the plant.

The material which passes through the grizzly and into the hopper below is fed on to a twenty inch belt conveyor through a Link-Belt feeder. This conveyor is in two sections. The first is about three hundred feet long and extends from the previously mentioned hopper to the foot of an incline which leads up to the screening and washing plant. Idlers and belt for this section were supplied by the Conveying Weigher Company. The second section of this conveyor is on the incline to the screens, and is ninety-six feet between centers and the idlers and belt were obtained from the

Loading a Truck with Sand. Little Falls

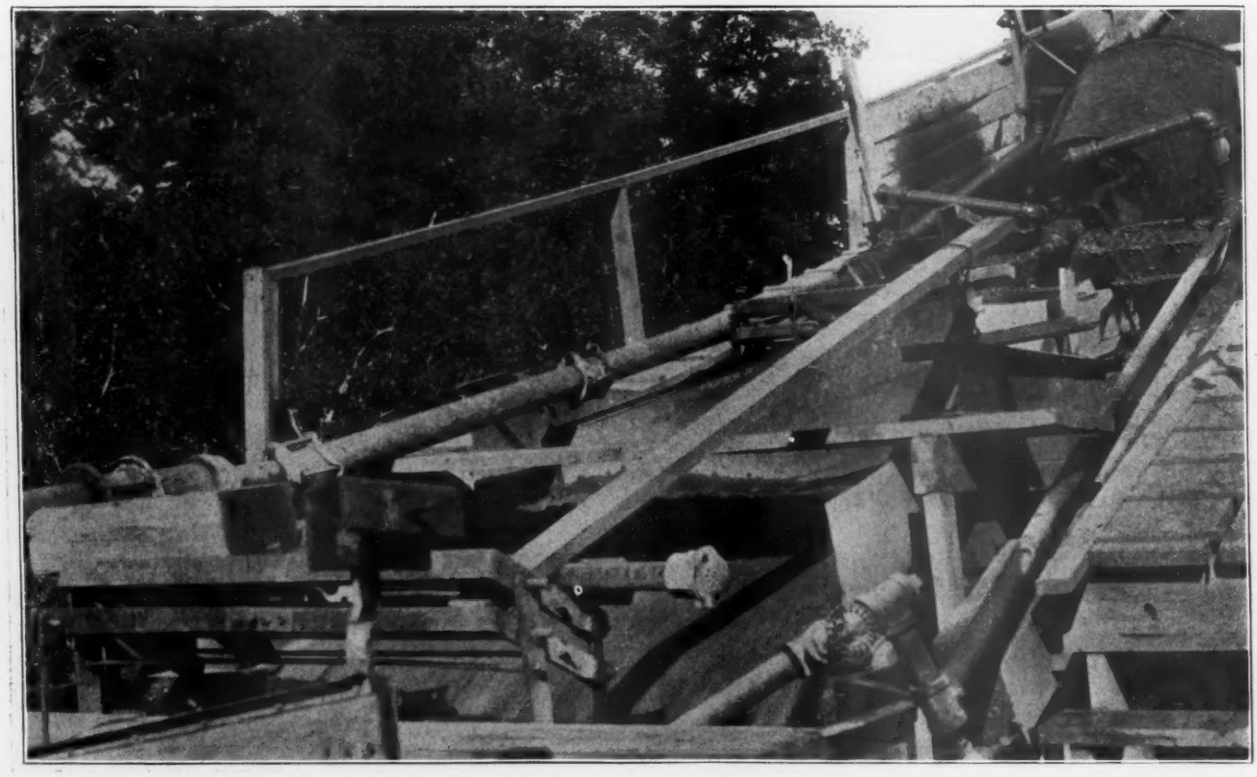


View of Belt Loader and Part of Crane. Little Falls

Link-Belt Company. This conveyor is a great labor saver and aid in holding down the production costs necessary in this highly competitve territory.

Screening is by a Link-Belt three section conical screen. The first section removes everything above the 1½ inch sizes and washing is also started at this point. The second section takes out the 1½ inch size and the third section the ¾ inch size. There are also two Allen settling tanks, the one nearer the screens being at a slightly higher elevation.

Conveyor leaving the Grizzly. Little Falls.



View of Conical Screen. Little Falls

Dump Car Carrying Cobbles from Grizzly to Waste Pile.
Little Falls

Conveyor from Grizzly to top of incline.
Little Falls

The first tank accumulates the coarse sand and the second fine sand, the overflow running through troughs to settling basins.

The sizes in excess of 1½ inches, taken out at the first section of the conical screen, descend by gravity to a 24x13 inch Farrel crusher. From this machine the crushed stone is returned to the screen section by the Jeffrey elevator.

Of course the demand for different sizes of material varies from time to time, depending on the construction work being served. At the time of the writer's visit the 1¼ inch sizes were being crushed; the ¾ inch size contained everything between ¼ inch and ¾ inch and the coarse sand contained everything below the ¼ inch execpt the fine sand.

Mr. Crawford, Superintendent and the Engineer of the Hoist.
Little Falls

The gravel and crushed stone are stored in bins and loaded into trucks through chutes. The sand is run out from the settling tanks to outside storage piles. From these it is loaded on motor trucks by a Browning electric crawler crane having a forty foot boom and ¾ yard Hayward bucket. Mr. William Crawford, the superintendent, seemed to be well satisfied with this crane and said it was giving excellent service. A Robins electric belt loader is also used to load trucks from the outside piles.

During the month of August, the production amounted to 4,208 yards of sand and 617 yards of ¾ inch gravel. This was accomplished with five men, besides the superintendent, who were disposed of as follows: One man at the hoisting en-

Drag Line Scraper in Operation in Sand and Gravel Pit. Cedar Grove

gine which operates the drag line; one man at the grizzly; one at the screens; one at the crusher and one on the crane. In addition to this, one or two laborers are employed at various times to clean up and do miscellaneous odd jobs.

The water question at this plant has called for a considerable degree of ingenuity. The supply is the same small stream from which the Cedar Grove Sand and Gravel Company, located just above this plant, draws its water and a short distance below this point is a wet wash laundry which also uses the water. Thus it will be seen the amount of water available is limited and also dirty overflow water after washing gravel cannot be returned directly to the brook on account of the laundry.

The manner in which these conditions are met is to discharge the dirty water into a settling pond and after clarifying the water it is then pumped back to the screening plant. Only enough water is taken from the brook to make up for water losses and to keep the pond full. Two Worthington centrifugal pumps, located in a small building adjacent to the storage bins, are used for this purpose. The piping and location of the Jenkin's valves are so arranged that either pump may draw from the brook or pond or they may be both open at the same time; one drawing from the brook, the other from the pond. At present, the Browning crane is used to clean out the pond but it is planned to install a dredging pump which will discharge into a worked out portion of the pit.

The plant maintains a repair shop located in the pump house for doing any incidental work. Among

Lower End of Conveyor, Grizzly and Sheave for Drag Line. Cedar Grove

Bucket on End of Crane for Loading Sand Bins. Cedar Grove

View of Inclined Conveyor. Cedar Grove

the various articles of equipment here are a Black and Decker grinder and a Buffalo forge. It is also interesting to note that Alemite lubricating equipment has been installed throughout the plant.

All transportation is by truck. This is done chiefly by the Malpar Trucking Company of Montclair, New Jersey, which has a fleet of thirty trucks, almost all of which are Pierce-Arrow with 5 yard bodies.

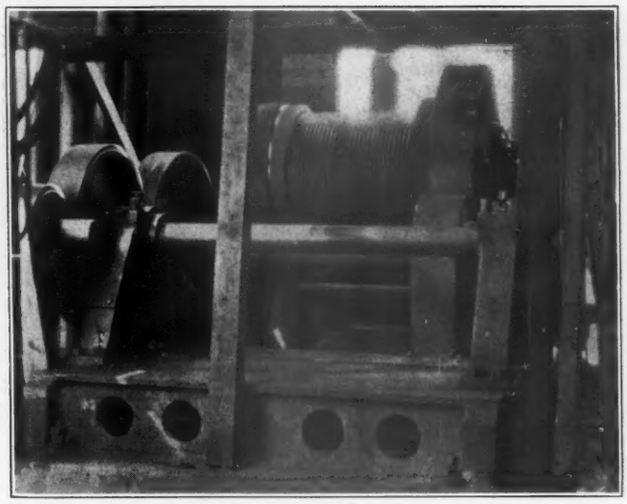
It is expected to operate this plant during the coming winter to as great an extent as possible. The plant also sometimes runs at night when there is a rush of orders, and for this purpose, a complete installation of electric lights has been made.

There is another sand and gravel operation known as the Cedar Grove Sand and Gravel Company, located adjacent to the Little Falls Sand and Gravel Company near Little Falls, New Jersey. In fact, both plants use the same brook to obtain water for washing. The character of the deposit apparently lends itself to the use of a drag line scraper, as this method of excavation is also used here.

The pit with the Green drag line scraper is shown in one of the illustrations. The amount of stone of crushing size varies in this bank so that two A-frames for the outward end of the drag line have been installed. One of these is over a sandy portion of the bank and the other over a stony section. The cable is easily shifted from one frame to the other, to get the desired mixture. American Steel and Wire Company's double ply wire rope, one inch diameter for hauling and three-quarter inch for the back pull, is used to operate the scraper. The bank is occasionally blasted down but this is not often necessary. The hoist is driven

Bird's Eye View of Two of the Settling Tanks. Cedar Grove

Loader and Piles of Surplus. Cedar Grove



Hoisting Machinery Used with Drag Line. Cedar Grove

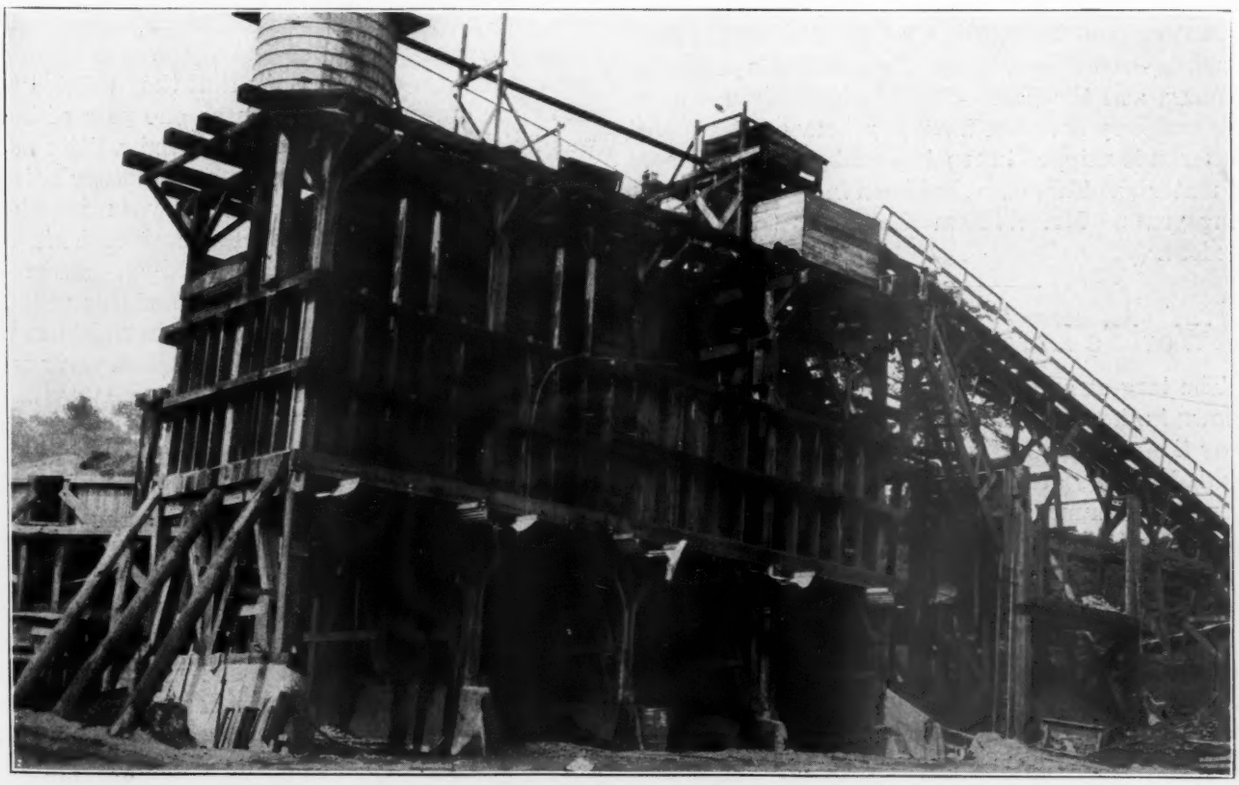
by a Westinghouse motor. The means for supplying power are unusual for this kind of plant. It consists of a Venn-Severin oil engine which drives a General Electric Company A. C. generator, and is sufficient to carry the electrical load of the plant. However, arrangements have been made with the Public Service Electric Company to secure power for breakdowns.

Sand and gravel picked up by the scraper are dumped into a hopper. The lower end of a belt conveyor is under this hopper and carries the material up an incline to the screens. The flow of material from the hopper to the conveyor is controlled by a Green feeder. The belt conveyor idlers are also Green make and the belt, which is twenty inches wide, was supplied by Goodyear.

Material is discharged from the conveyor into a box, through which a stream of water flows, at the top of the plant. From this box the material is washed into a Telsmith screen. This separates the material into the following sizes, two inch, three-quarter inch, coarse sand and brick sand. The tailings drop into a No. 2 Aurora jaw rock crusher which has been rebuilt by the General Equipment Company. From the crusher the stone is carried on a belt conveyor to the inclined conveyor and by this to the screen.

Crushed stone and gravel from the screens is deposited in bins from which trucks may be loaded. Sand from the Telsmith settling tanks is run out in piles back of the bins. It is picked up from these piles by a thirty foot crane, which carries a Browning half yard bucket operated by a Byers steam hoist, and deposited in separate loading bins.

A loader, made by the Portable Machinery Company, is used for making piles of surplus and also for loading trucks from these piles. In fact, belt loaders seem to be almost as regular a part of the equipment of any plant, large enough to accumulate



General View of Plant Showing Top of Incline. Cedar Grove

Truck Load of Material Ready to Leave Cedar Grove Plant

a surplus, as screens. Of course, this is only reasonable as a good loader is a great labor saver and because large capacity bins are expensive, outdoor piles of surplus are unavoidable. Furthermore, it is also a necessity for any concern, supplying the general contracting trade, to carry a surplus of various sizes on hand so as to be in a position to render satisfactory service.

The water supply at this operation is involved in similar conditions to the Little Falls Sand and Gravel Company. That is, dirty water after washing the sand cannot be discharged into the brook because of a steam laundry lower down the stream. Neither is there a surplus supply so that it can be wasted. Therefore the water is clarified by allowing it to pass through four settling basins, overflowing from one into another, before returning to the brook. The supply for washing is pumped from the brook by a motor driven Westinghouse centrifugal pump.

A Cleveland Tractor is kept on hand to do heavy work around the plant such as moving machinery, timbers and the like. This is especially useful as the company does not have any heavy trucks. All material is shipped in trucks sent by the purchasers of material. This plant has been in operation about four years. Mr. William Diercks is the superintendent.

World's Largest Mercury Deposit

The largest and richest deposit of mercury now known in the world is at Almaden, in Central Spain, near the extreme western point of the Province of Ciudad Real, states the Bureau of Mines, Department of Commerce, in the statistical report on "Mercury in 1925." This deposit has been mined almost continuously since Roman times and has been owned and worked by the Spanish Government since 1645. The ore bodies are large, some of them attaining 36 feet in width and as much as 600 feet in length. The mine has been developed to a depth of more than 2,000 feet and the available reserve has been estimated as at least 40,000 metric tons of metal.

In the lower workings the ore shoots are longer, the tenor of the ore is higher, and the vein is wider. The average content of all ore mined is said to be about 8 per cent. According to Spanish Government reports, however, the mercury extracted was 6.06 per cent in 1922. The production in the past two years has amounted to about 26,000 flasks per annum. In 1924 the productivity per man was 18.53 flasks. The pre-war average cost of producing a flask has been estimated at $15; since the war the working costs have been estimated at $45 per flask. Deposits of minor importance are found in the Provinces of Asturias, Badajos, Granada, Santander, and Valencia.

Development of the Diamond Drill

The diamond drill, which was invented about 1863 by Robert Leschot, a French engineer employed on the Mont Cenis Tunnel, is the oldest form of the core drill, states the Bureau of Mines, Department of Commerce, in a recently issued bulletin. In his youth Leschot had been a watchmaker and had thus become familiar with the wearing qualities of the jewels in watches. Observing that the steel in the bits used to bore holes for blasting wore out quickly in the hard rock, he conceived the idea of setting diamonds in the bits to make them wear longer, probably using white diamonds instead of the black stones.

The diamond drill was first used in the United States during the late sixties at the Vermont marble quarries, before the steel saw had been invented for cutting out blocks of marble. Instead of a steel saw being used to cut the marble into blocks, as is now the practice, a series of small diamond-drill holes was bored along the line of the slab. Some of these machines were so built that they rotated two bits simultaneously. As soon as one pair of holes was finished, the machine was moved a little more than the diameter of the hole and another pair of holes was drilled; in this way a cut was made along practically the entire line of the slab. This bit, known as a bore head, was solid and cut no core.

M. C. Bullock saw the advantage of this drill for prospecting and bought the American rights to the Leschot patent. The earliest exploration work with the diamond drill was probably in the Pennsylvania coal fields, where, in 1872, a hole 700 feet deep was sunk by the diamond drill. It is interesting to contrast this hole with the 7,347-foot hole drilled with a diamond drill by the Imperial German Government near Czuchow, Upper Silesia, Germany, in 1909.

In the early seventies the diamond drill was used in drilling holes for blasting out the well-known Hell Gate Reef, which long had menaced navigation in New York Harbor. About that time the Michigan copper and iron ranges were being explored and developed and the diamond drill was first used extensively there.

INCREASES PRODUCTION WITH SMALL COST

By E. D. Roberts

HOW TO increase production without lowering the quality of the output is a question asked by many operators. To give an intelligent answer one must know something of the deposit, the machinery installed and the methods of operation. In some plants the answer would be additional equipment; at others a new plant, and again for other operators slight changes in present equipment.

The Consumers Company, Chicago, Illinois, own, lease and operate a great many sand, gravel, and crushed stone plants within a short distance of Chicago, Illinois, and have solved this problem at their South Beloit, Wisconsin, plant without much expenditure of money. Two simple additions or changes were made; side boards were placed on the 24 inch inclined conveyor belt and a "Rolman" Manganese Steel Forge Company manganese steel screen was placed on the 48 inch scalping screen. As a result of these changes, the company is now able to convey over 4,000 tons of sand, gravel and crushed rock over the 24 inch inclined belt in 12 hours' time.

A number of live salesmen operating from the head office of the company in Chicago, create a ready market for the company's products and, as a result, most of the material is sent to Chicago for distribution.

The South Beloit plant was started many years ago by the Chicago, Milwaukee and St. Paul Railroad as a ballast pit. Later, the Federal Sand and Gravel Company took over the pit and operated it for a time when they sold to the United States Building Material Company. This last and present owner of the gravel deposit leased the pit to the Consumers Company, which is now producing sand, gravel and ballast from the site. The deposit is located on a level plain just south of Beloit. The top four feet of the deposit is earth, which is removed, and under this is found 40 feet of good sand and gravel before water is encountered.

When the Consumers Company took over the pit for operation, a face 40 feet in height was found extending south for 3,000 feet. The old ballast pit was arranged with railroad tracks and was being used for car storage. It was decided that the remaining worked over area would be required for ground storage and for the company's pit tracks. As a consequence, a Monighan full revolving drag line was installed to remove the overburden and throw it to the west on top of virgin ground. This drag line has a boom 100 feet long and is equipped with a Page 3¼ yard drag bucket. A special wide gauge track, made up in 15 foot sections resting on pads, is used to support the drag shovel. The machine handles its own track from the rear to the front when a move is desired. One sweep of the drag line strips enough ground for three cuts with the steam shovel.

After the drag line has cleared enough ground for a year's operation, usually less than 5 months, it is used to load the cars instead of the steam shovel. When digging gravel it moves back from the excavated area instead of ahead as when stripping. A special 50 yard steel bin with hoppered opening has been constructed on a movable tower, and the drag line places this bin over the track and fills it with gravel and sand. A train of three 16 yard Western dump cars is then spotted under the bin and loaded. While the train is trans-

View of Stripping Operation

porting the load to the receiving hopper the bin is refilled by the drag line before the train returns for the next load. This method of operation has proven much cheaper than excavation by the steam shovel as fewer men are required to operate the dragline and it always has a full bin for the train before it returns.

As sufficient space has been provided in the pit for all storage and track needs, the present stripping removed by the drag line is thrown into the worked over portion of the pit. The stripping from the 55 acres of gravel, yet remaining on the site, will also be thrown into the worked over area. A 55 ton Bucyrus, railroad type, steam shovel is used when the drag line is stripping, for excavating the sand and gravel. This shovel is equipped with a 2½ yard bucket and loads the material into 16 yard Western dump cars. The cars are moved in trains of three by a 40 ton American, saddle type, steam locomotive. One train of cars keeps the plant operating to capacity because fast time is made by it in running from the shovel to the receiving hopper and returning. This is due to the care taken of the track construction.

When a new cut is started, the shovel is started to load the gravel while two men relay the track ahead throughout the length of the pit. The old track rails are then taken up and rebuilt in the new position thus assuring a good track, to gauge and with the ties properly spaced. As a result no derailments occur due to incorrect gauge, loose spikes, poor surface or other troubles encountered with pit tracks. The absence of pit track trouble has also greatly increased the output of the plant.

The steam locomotive pushes its train of cars just past the receiving hopper in order to spot them for unloading on the open grade back to the pit. The track at the hopper has been elevated on the opposite side so that the cars will lean, and can therefore be dumped easier when desired. This it would be necessary to give the cars a tilt in one direction. It also allows better running time on the track because a car that is loaded evenly will not be so liable of derailment when passing over a soft spot in the track as would be the case if the car were given a heavy tilt to one side.

Grizzly bars, placed over the top of the hopper, prevent any boulders greater than 8 inches in diameter, from entering the hopper. However, it has very little use as most of the rock is under 4 inches in size. The hopper will hold 60 yards of material which is more than the 48 yards brought by one train.

A slide gate in the bottom of the hopper controls the rate of flow to the 24 inch belt below. This conveyor belt runs horizontally for a few feet and then up a sharp incline to the top of the scalping and crushing shed. Walls have been placed on the sides of the belt so that it can carry a greater load than an ordinary 24 inch belt. These side walls are 3x30 inch pieces of steel one-eighth inch thick, three inches being bent up at right angle on each end. The pieces are riveted to the belt so as to form a continuous wall three inches high on each side of the belt. In operating, the side walls do not interfere with the passage of the belt around the end pulleys.

This Manhattan belt carries a full load of sand and gravel to which is added a top layer of crushed rock when the belt is half way up the incline. This crushed rock is brought from the crushers by an inclined belt which raises it high enough so that the material will flow by gravity on to the receiving belt. At the top of the incline the receiving, or

Looking Up Number 1 Belt, Crushed Material Falling on Raw Material to Scalper

number one belt, discharges at right angles into a 48 inch by 12 foot scalping screen. This screen was originally equipped with round holes cut in the plate, but, to increase production, the first half has been replaced by a "Rolman" Manganese Steel Forge Company steel managanese screen with 2 inch square openings. This mesh opening gives a greater number of openings per area but requires an exceptionally strong wire to withstand the wear to which it is subjected.

The material which passes through the scalper falls through a hoppered box on to a second 24 inch inclined belt which leads to the sizing and washing screens. A curved steel plate at the bottom of the hoppered box causes the material to slide on the belt instead of falling on it and then bouncing off.

The oversize material that does not pass through the holes in the scalping screen falls into a dividing chute, one side leading to a No. 5 Austin gyratory crusher and the other side leading to a No. 3 Allis Chalmers crusher. After passing through the crushers, the broken rock is united in a common chute leading to the return belt, previously mentioned, that discharges on the number 1 belt bringing the raw material from the receiving hopper. A special provision has been made to tap a flow of sand on to this return belt in case the amount of crushed stone is so small that it bounces on the belt. However, most of the crushed stone passes through the holes in the scalper and goes to the sizing screens with the sand and small stones. The Link Belt system of conical screens is used to wash and grade the sand and gravel. A board causes the stream of material to divide as it falls from the number 2 belt, one part going to the right set of screens while the other goes to the left set of screens. A 4 inch stream of water is supplied to the sand and gravel as it enters the screens while later another 4 inch stream of water gives it a second washing. In all, a total of 500 gallons per minute is used on each set of screens, and carries away the silt and fine sand in the material.

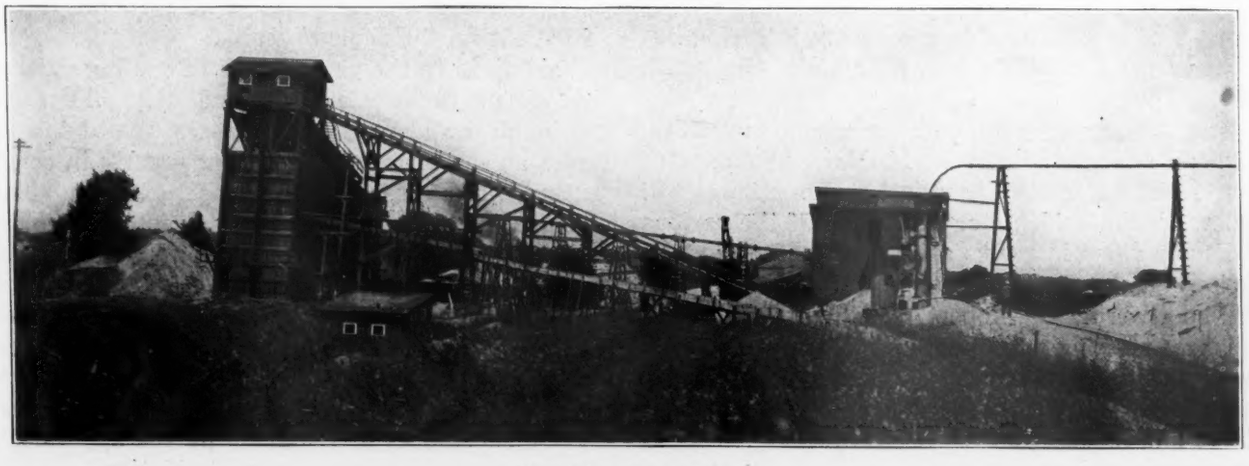
As the material passes through each of the series of screens, it cascades down to the next series of screens while the oversize falls into a bin ready for shipment. The last of the grades produced by the screens is roofing sand after which the finer material and water, in which it is carried, is passed through two sets of settling tanks, made after the Consumer Company's own designs. These settling tanks produce concrete sand and masons' sand and allow the wash-water and fine particles to flow off in a flume to a settling basin.

The shipping bins are located between two tracks and have spouts leading out on each side so that cars can be loaded from both sides at once if necessary. The spouts from the roofing sand and gravel bins are equipped with double bottomed chutes, the upper having wire mesh while the lower is solid metal in order to catch the water, spraying on the gravel as it runs down the chute. This final washing ensures a cleaner nicer appearing product. A 50 ton engine is used for spotting the cars for loading and to place the loaded cars on the proper outgoing tracks.

Ground storage for 75,000 yards of material is available. The surplus materials are placed in this storage by a 25 ton McMyler-Interstate locomotive crane equipped with a 1½ yard McMyler clam shell bucket. This crane also reclaims when shipments are being made from the storage. As is the case with many other operators, a large part of the early season output is placed into storage while the demand is low, but is moved out during the peak demand of the season when the plant is not able to meet the sales.

Plant water, as well as the water used in washing the sand and gravel, is furnished by electrically driven pumps, one a 6 inch Allis-Chalmers centrifugal and the other an American Well Works two stage centrifugal. All the plant units are driven by individual electric motors with the exception of the two gyratory crushers and the scalping screen which are operated from a drive shaft, belt driven, with 50 horsepower General Electric motor.

The office is able to keep a close check on the production by the use of a Bristol recorder. This recorder, by means of an electric circuit placed in



South Elevation of Plant

the track at the receiving hopper, registers each trip of the steam locomotive. These trips are recorded by offsets in a line traced on the rotating card by the stylus and give the plant superintendent, Mr. E. B. Dowd, a record of the day's work, and, if the stylus has failed to record a trip for some time, the cause of the delay is then investigated.

The officers of the Consumers Company are: Mr. Stuyvesant Peabody, President; Mr. M. E. Keig, Vice President; Mr. G. H. Webber, Secretary, and Mr. E. F. Johnson, Treasurer. The general offices of the company are at Chicago, Illinois.

Annual Slate Meeting Promises Much

From the present outlook the Annual meeting of the Slate Industry to be held January 18 and 19, at the Commodore Hotel, New York City, promises to be the largest as well as the most interesting gathering of its kind in the history of the industry. This industry embraces those who quarry slate, mill and market or sell it, and also slate roofers and slate setters. Representatives from all these branches of industry will be present. Other men of prominence will also be there and take part in discussions of vital importance to the Slate industry.

The N. S. A., which was organized in 1922, has sponsored these annual get-togethers as a means of stimulating the entire trade to greater effort. Some of the results of the work done by the Association are shown by the fact that during the five years of its existence, the value of slate sales has almost doubled. Educational and missionary work, publicity and advertising by the Association have brought slate before the public in a way they can understand, has enlightened architects and builders to the many possibilities of using this stone in its manifold and diversified uses in building construction. During the last five years, changes and improvements in quarry methods have made it possible to produce more economically a greater amount of slate for all its uses than has been done before. Advantage is being taken of methods successfully used abroad and with the cooperation of the U. S. Bureau of Mines, the Slate industry is trying out some of these methods to facilitate the production of slate.

The meeting will open on Tuesday, January 18th, with an address by Mr. N. M. Male, president of the National Slate Association, greetings will follow from presidents or executives of the various bodies or allied interests specifying or using slate. Following a buffet lunch an inspirational address will be given by Dr. Robert W. McLaughlin. Then the mass meeting will break up into groups of each branch of the industry for intensive discussion of their intimate problems, followed by the annual dinner and theatre party.

Group meetings continue on Wednesday, the 19th, and at noon will be held the Hosts' Club Luncheon to the Slate Trade, an annual affair given by the Hosts' Club Associate members of the National Slate Association, firms who furnish the slate industry equipment and supplies or services. Rev. Steinmetz will be present at this gathering.

The conferences close with a joint session of Slate Roofing Contractors and the United Roofing Contractors Association of America, presided over by George E. Moore, president of the latter body. This group will continue in Annual Convention for two days longer. This has been made possible owing to the efforts of Anthony Golden of the Globe Slag Roofing Company, Scranton, a member of both organizations, by moving ahead the Convention dates of the United States Roofing Contractors Association.

Nature of Oil Shale

The term "oil shale" covers a wide variety of solidified mixtures of argillaceous sediments and organic matter, states Lewis C. Karrick in a recently issued report of the Bureau of Mines, Department of Commerce. The muds from which the shales were formed came from the erosion of many kinds of rocks within great drainage areas. The eroded materials were transported by streams to their final points of deposition—probably freshwater lakes. The proportions of the component minerals differ in different parts of the shale beds because of the proximity of these areas to the sources of those minerals. Futhermore, the products of erosion varied as streams altered their courses and changes in the contours of the weathering mountains exposed different rocks to the elements. Therefore oil shales in different parts of the same formation vary in the proportions of their chief mineral constituents, such as quartz, pyrite, gypsum, and the silicates and carbonates of sodium, calcium, and magnesium. The organic matter in the shale is generally accepted to be plant remains derived either from accumulation of vegetation carried by streams into the lakes or from algae that grew in the lakes. The plant remains became partly decomposed before they were solidified and sealed within the shale deposits.

Variations in the percentages of the ingredients that form the shale beds and the effects of geochemical and physical processes caused the oil shales as they now exist to differ greatly in color, texture, hardness, and resistance to erosion. The oil-shale measures contain many beds of oil shale, and the yield of oil ranges from a negligibly small quantity in some beds to as high as 80 gallons per ton of shale in others. The organic substances of true oil shales is only slightly soluble in the common solvents of bitumen. Oil, therefore, is not present as oil in the shale, but must be formed from the organic substances of the shale by the application of heat; that is, by destructive distillation.

A SYSTEMATICALLY ARRANGED LIME PLANT

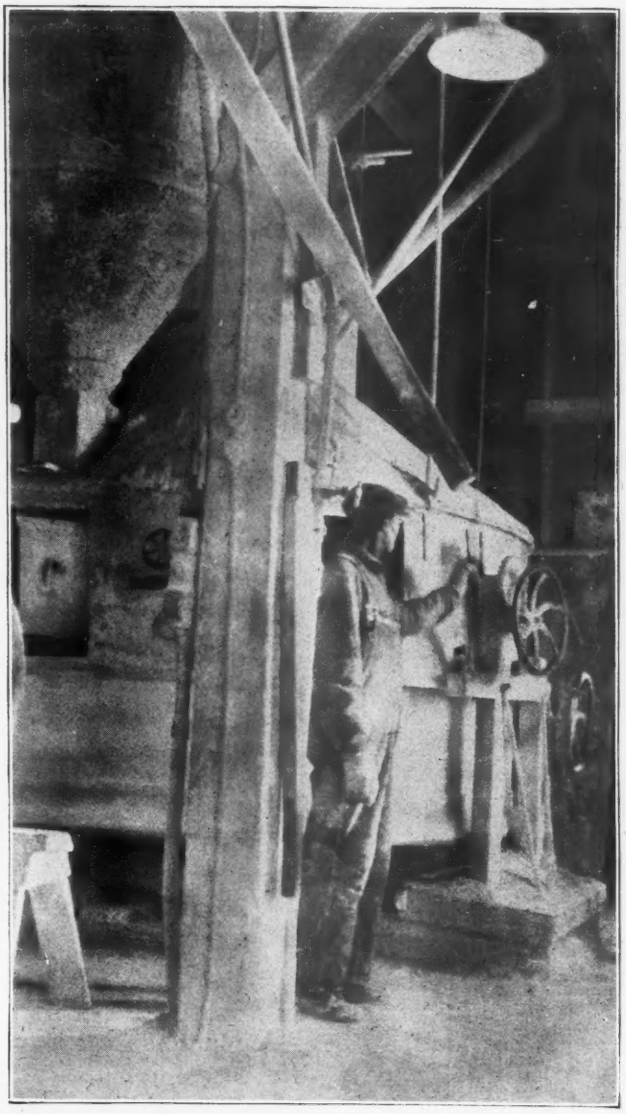
By F. A. Westbrook

THE New England Lime Company has an operation at Canaan, Connecticut, consisting of a quarry, seven kilns and a hydrating plant. It is extremely well laid out and equipped. The operations are not complicated but they are systematically carried out with due regard to the saving of labor. The quarry is located about a half mile from the kilns and it has the advantage of being so situated that the tracks have an easy down grade, practically all the way, with only one or two short level stretches. This makes it an easy matter to transport the stone.

Of course, it is necessary to haul the cars out of the quarry over an incline and this is done with an American Hoist and Derrick Company electric hoist using Broderick and Bascom "Yellow Strand" cable. The cars are then taken down by horses to the kilns, but on account of the favorable grade they have little to do except to pull back the empties. The narrow gauge track fans out at the lower end so that there is a separate trestle to each. Two horses handle about twenty-three loads per day.

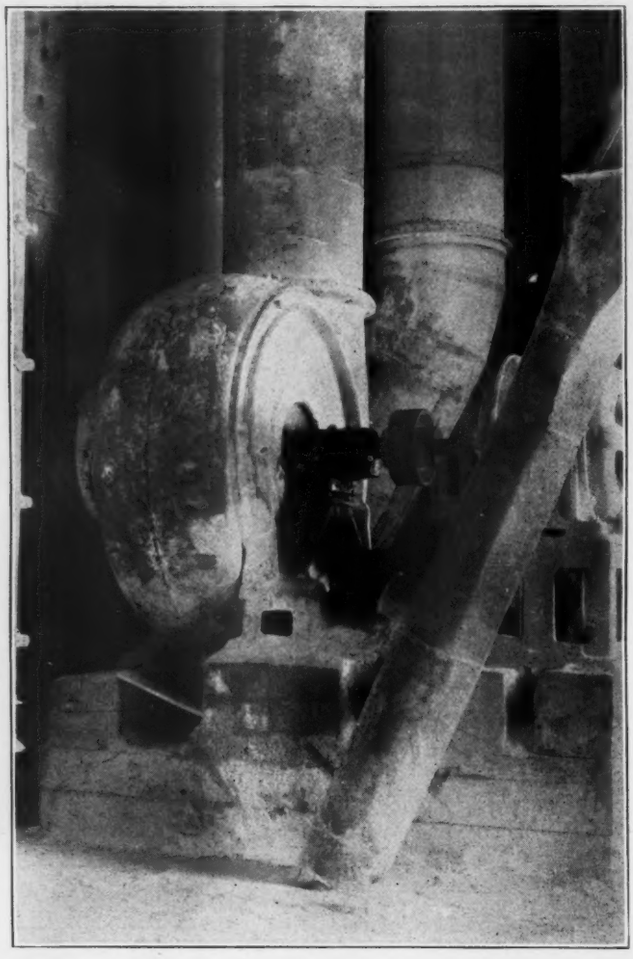
Drilling is done by means of a seventy-five pound Ingersoll-Rand drill for the large holes and two small jack hammers for breaking up the blocks. A 12x10 inch Ingersoll-Rand compressor supplies the air. Both the compressor and the hoist are driven by General Electric Company motors. The drills are sharpened by hand in a small separate building. The forge is equipped with a Champion blower and the hardening is done in waste oil taken from the machinery in the plant.

The kilns are coal fired and there is a siding which branches near the plant so that a line of tracks is adjacent to the firing floor where the coal is dumped at a number of points. In this way, sub-



One of the Hydrators

Looking Down Into the Quarry

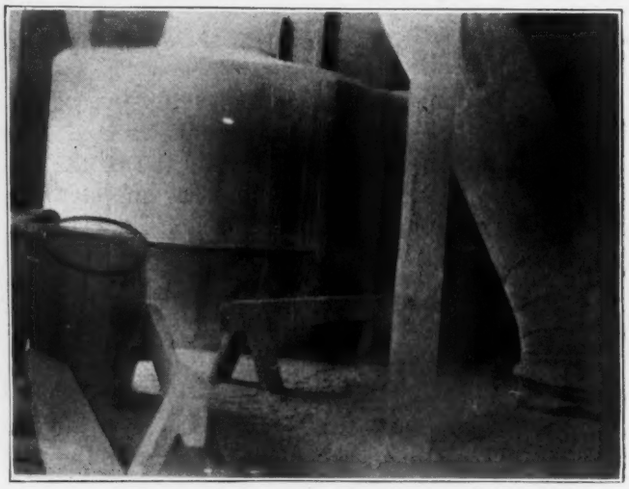


Blower for Kilns

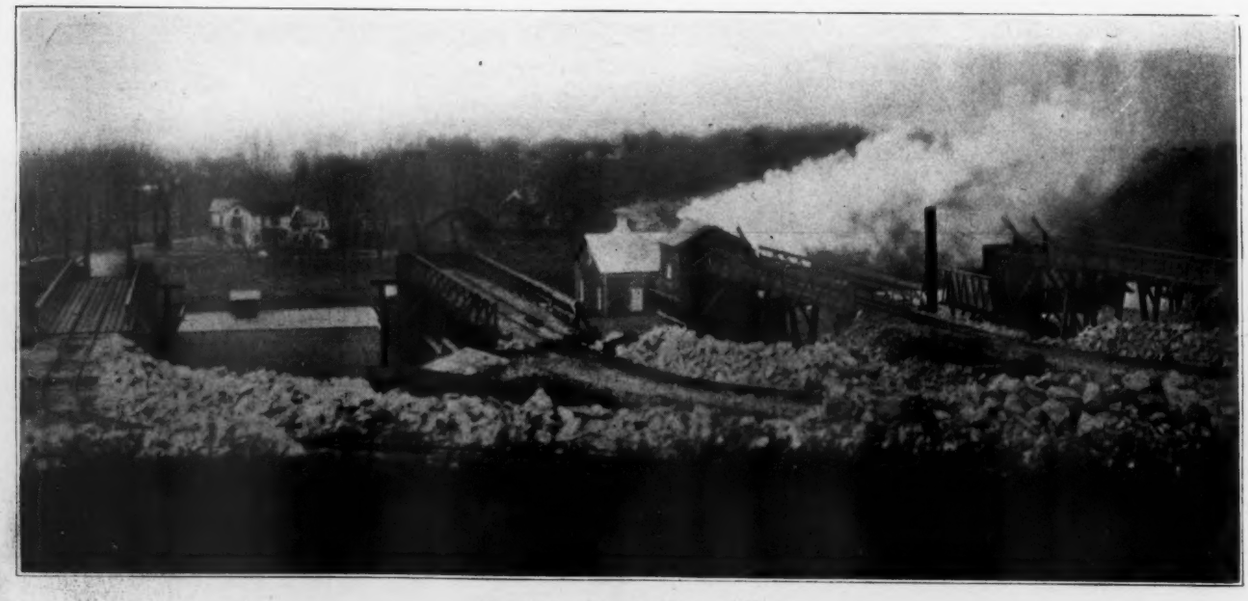
sequent handling is reduced to the minimum. The lime drawing floor is kept in a neat condition, the lime and barrels being arranged in orderly piles. Another branch of the siding is adjacent to the drawing floor so that barrels or lime in bulk may be loaded directly on to box cars for shipment. Wood barrels are chiefly used at present which are

Hoisting Engine at Quarry

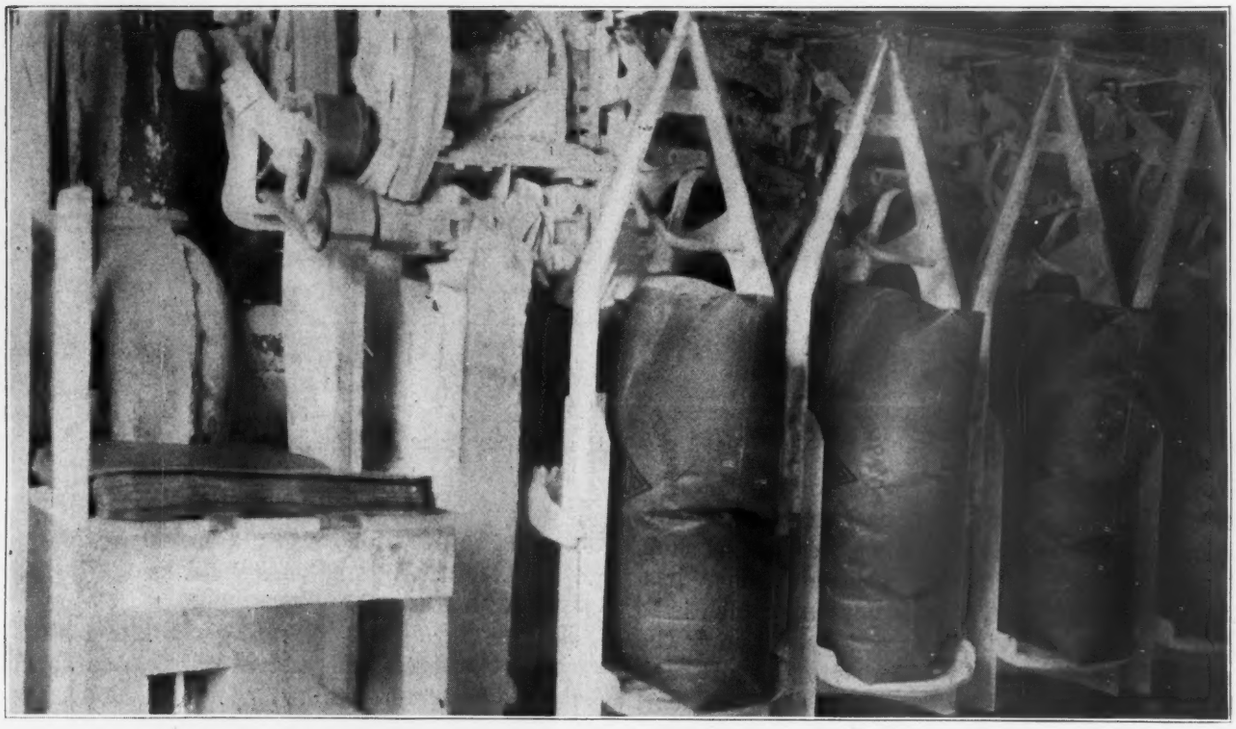
made in the Company's cooperage shop. This is equipped with a complete outfit of Holmes Machinery Company barrel making machinery and has a capacity of one thousand barrels a day with eight men. Steel barrels are also used but, at present,



Cyclone Collector

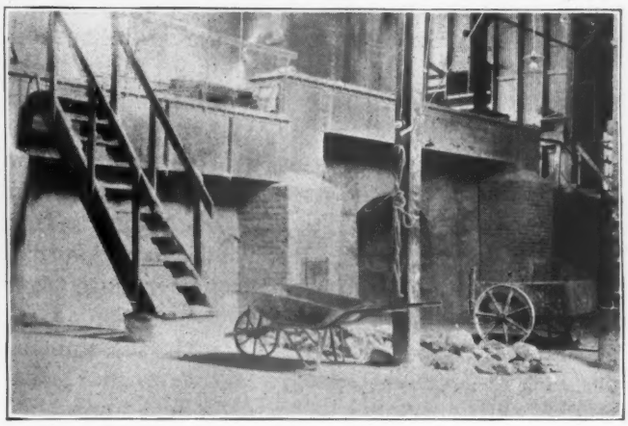


Tracks Leading to Top of Kilns



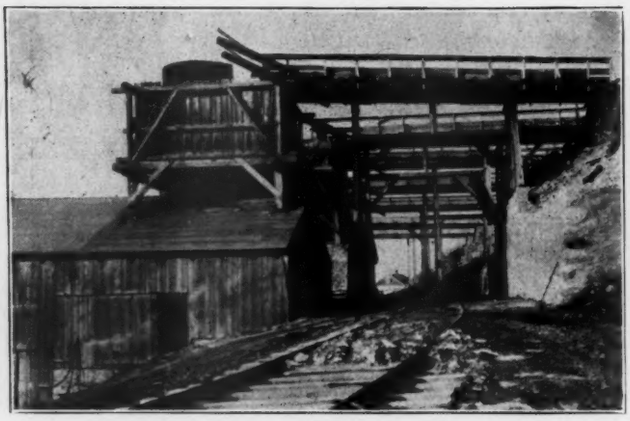
Bagging the Cement

Firing Floor of Kiln House



Lime Drawing Floor

Sidings of Lime Shipping Department at right. Hydrated Lime Shipping at left.



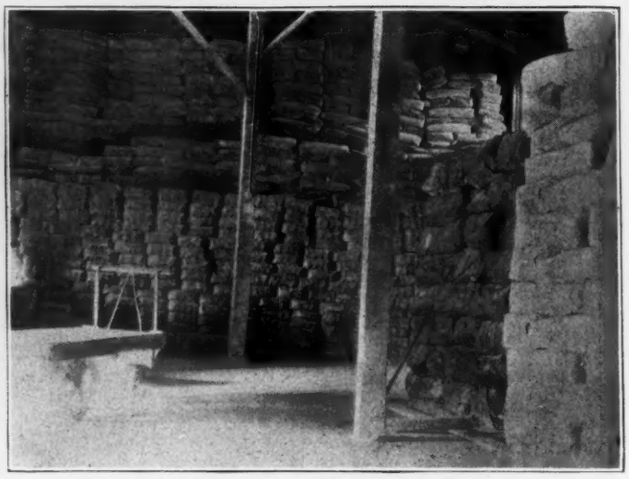
Coal Siding and Side View of Tracks to Kilns

these are shipped from one of the Company's other plants. However, a building is in course of construction which will be used for a steel barrel shop.

At the center of the lime drawing floor is a Sturtevant rotary fine grinder for lime which is to be hydrated. The grinder is fed by dumping the material into it from wheel barrows and hand trucks, the opening being on a level with the floor. The ground lime is then picked up by a Weller elevator and delivered to a Weller ribbon conveyor which takes it across the sidings to the hydrating plant. The ground lime from the kiln house is stored in bins in the hydrator house. From there it passes through a chute to a weighing machine and then into one of two Clyde hydrators. After slacking, this lime drops on a Weller screw conveyor, in the basement, and this discharges into an elevator which conveys the lime to a seven ton bin. There is also a Raymond five roller high side mill in the basement, which is fed through a chute from this bin.

From the mill the pulverized hydrated lime is carried by means of a Raymond number 11 exhauster, with a direct connected 42 inch fan wheel operating at 1,200 r.p.m., through a 4 foot 6 inch separator and then to a 7 foot Cyclone collector. The latter discharges into an elevator which carries the material to the bin over the Bates bagger. The blower is on the hydrator floor, above the mill, and the collector is partly on the second floor but extends down through it. The capacity of this hydrating plant is fifty tons a day and the average production of the kilns is ten tons a day. The plant operates all winter.

Weighing a Load As It Comes From the Quarry



Storeroom of Hydrating Department

At one end of the hydrating plant is a storage space for bagged lime and at times holds a considerable accumulation. A large door has been provided alongside the Bates bagger through which freight cars on the siding outside may be loaded directly from the machine. This saves handling but when there is no car to be loaded the bags are stored inside the building. The office is a very attractive building with several rooms, well heated and provided with running water. Neatness is apparent here in keeping with the rest of the plant and grounds. Mr. H. J. Waller, is superintendent for this plant of the company.

Sources of Credit Information

1. The reports of the large mercantile agencies.
2. The financial or "property" statement of the buyer.
3. Ledger experience secured from others who have dealt with the customer, including trade "opinions."
4. The reports of the company's salesmen.
5. Information received through banks.
6. Information gained through personal interviews conducted by the credit man or by the company's special credit investigators.
7. Reports of local attorneys.
8. Reports secured through trade associations, local credit exchange bureaus, and particullarly from the Credit Clearing House, which in recent years has been "checking" more than half a million retail buyers.

The Only Pyrophyllite Deposits

The only commercial deposits of pyrophyllite known in the United States are found in Moore and Chatham Counties in North Carolina. This mineral which is much like talc, has been known and mined for 70 years.

MODERN GRINDING AND SCREENING SYSTEMS IN THE PRODUCTION OF LIME

By Prof. Ernst Blau*

AT THE present time the lime industry no longer furnishes its product in lump form, as the lumps after only a short time disintegrate due to atmospheric influences, being transformed to a certain extent to slaked lime and become partially reverted to calcium carbonate, but is preferably furnished either as pulverized caustic lime or as slaked lime in which form it retains its mortar-forming properties for as long a time as is desirable for storage. Pulverized lime is bagged after its preparation, usually with the aid of automatic weighing devices, so-called bagging scales; the product is generally known as bagged lime. As a raw material those varieties of limestone are used which would hardly slake properly or perhaps not at all in lump form because of their high alumina content, and yet turn out to be most satisfactory in powdered form for mortar production. The yield as compared to the older production methods is higher for a given amount of raw material, as in the older processes the finer sizes were thrown on the dump heap. In addition bagged lime renders possible a distinctly simpler, more rapid and more economical utilization on the job. It may be added that bagged lime finds favor also in industries outside of the construction field as for instance as pulverized caustic lime in lime-sand artificial stone, in chemical plants, as fertilizer, etc.

The grinding of the raw materials was formerly carried out in hammer mills with screen delivery, but later preferably on screen ball mills. The latter have been generally adopted because they combine large production with relatively small power consumption and a low rate of wear and tear. A serious disadvantage in the case of these otherwise excellent machines is caused by the screens which deteriorate rapidly and in spite of close control easily lead to interruptions in production. Also in the case of a somewhat moist charge they give rise to low production. Finally in the case of very fine grinding they are no longer highly productive because they cannot screen the fine material produced quickly enough. The fine flour accumulates at the bottom of the grinding cylinder and insulates the coarser particles which are thus removed from the field of action of the grinding bodies.

These disadvantages are overcome by the new grinding and screening system of the "Alpine Maschinen-Aktien-Gesellschaft" of Augsburg, Germany, which uses the Orion-Mill, a screenless ball-mill and the screening device for which is provided outside of the Orion-Mill. The screenless, sturdy, dust-free "Wind Separator" of the above mentioned firm requires very little attention and can be adjusted to any desirable degree of fineness of product, and by the use of relatively insignificant quantities of power increases the output of existing ball-mill installations, depending on conditions, by 30-35 per cent.

The steamed lime which is the product resulting from the bringing together of burnt lime and water is a mixture of fine flour and larger lumps; it is transported by means of a delivery hopper through a chain-pump system which drops the material on a screw conveyor attached to its delivery end. Lumps under 10 mm. in size go to the air-separator which separates out the fines while the larger lumps and gravel fall back to the delivery hopper of the ball-mill. The material leaving the latter is again taken up by the chain-pump and thence to the air-separator so that only such material is returned to the ball-mill as is still in need of grinding. Once the air-separator is adjusted to a definite fineness it continues to give a uniform product. Figure 1 illustrates a lime plant with an Orion grinding mill installation.

In ball-mills the sharp corners and outer layers of the charge are first removed by the grinding bodies and these are ground to a flour. The cores resist the disintegrating action of the balls for a longer time but are finally broken up into gravel. On the basis of this fact the equipment of an Orion-Mill is provided; the cylinder of such a mill is shown in Figure 2.

Between the ridges of the grinding surface there are left for a certain distance on the charging side "a" discharge openings "b" for the charge. The rest of the grinding path is closed. The charge broken up by the balls into the dust hopper of the mill and is lifted from this by a chain-pump to the separator which takes care of the separation of the flour-fine from the coarser product. The fines can be dragged directly while the coarse is returned by means of a drop shaft to a second smaller hopper from which it is carried by means of projections "d" of the rear hub back to the grinding cylinder. In this it first passes along the closed portion "c" of the grinding path where it is subjected to an intense grinding action. Due to the force exerted by the material entering behind it it is forced to the slots "b" by means of which it leaves to start the circuit to the separator all over again. It should be noted that the closed portion "c" of the grinding cylinder can be adjusted to be longer or

*In Chemiker Zeitung November 24, 1926.

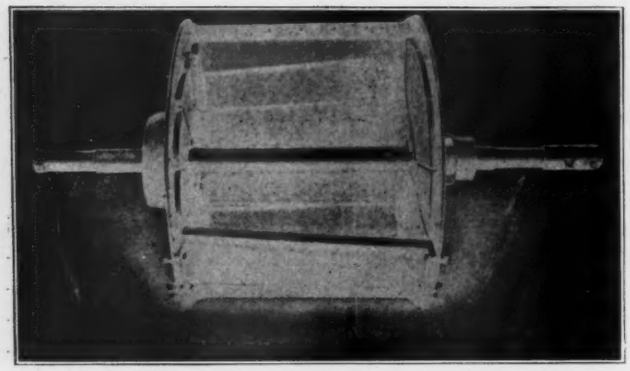


Figure 2.

shorter depending on the hardness of the lime to be ground.

The stage-wise arrangement of the grinding path makes it possible to lift the balls higher than if the surface were smooth. Furthermore the projections of the grinding plates extending toward the center of the mill cause a higher ball drop as the inner balls by the rotation of the cylinder are dragged along the upper portion of the balls and force these aside. For the pulverizing of the charge fed into the interior of the mill this violent fall of the balls is not only desirable but adsolutely necessary. On the other hand weaker blows suffice when the charge has been brought down to gravel size. As compared to compound mills in which the preliminary crushing is carried out in dropping-ball mills with stepwise grinding path and the final grinding in tube mills, the Orion Mill has the advantage that the grinding occurs in one continuous process. The warped construction of the grinding plates brings it about that the balls are rolled over one another like the soil before the turning board of a plough, in a direction extending from the delivery side of the charge toward the opposite end of the grinding cylinder. At this point they move back towards the delivery side to fill up the voids caused by the rolling of the balls over each other previously mentioned. This motion of the balls with respect to each other causes the charge not only to be crushed but also to be rubbed to pieces; in other words an effect is produced similar to that in a mortar where the charge is first crushed by pounding and then ground down to a powder.

Even for pulverizing hard materials the Orion-Mills are found to be most suitable. With the expenditure of small amounts of power, extraordinarily high production is obtained.

Almost more important than good grinding equipment for a bagged-lime works is a suitably designed and carefully constructed air-separator. The "Almag-Wind separator" built and marketed by the "Alpine Maschinen-Aktien-Gesellschaft" of Augsburg, Germany, meets the highest specifications as to capacity and accuracy of separation. In a single through-go of the charge it separates the maximum possible percentage of fines present; the product is thoroughly uniform and can be adjusted as to fineness in the greatest possible degree with-

Abb. 4. Sackkalkanlage der Firma The Buxton Lime Firms Ltd., Buxton (Derbyshire, England). Maßstab 1 : 250.

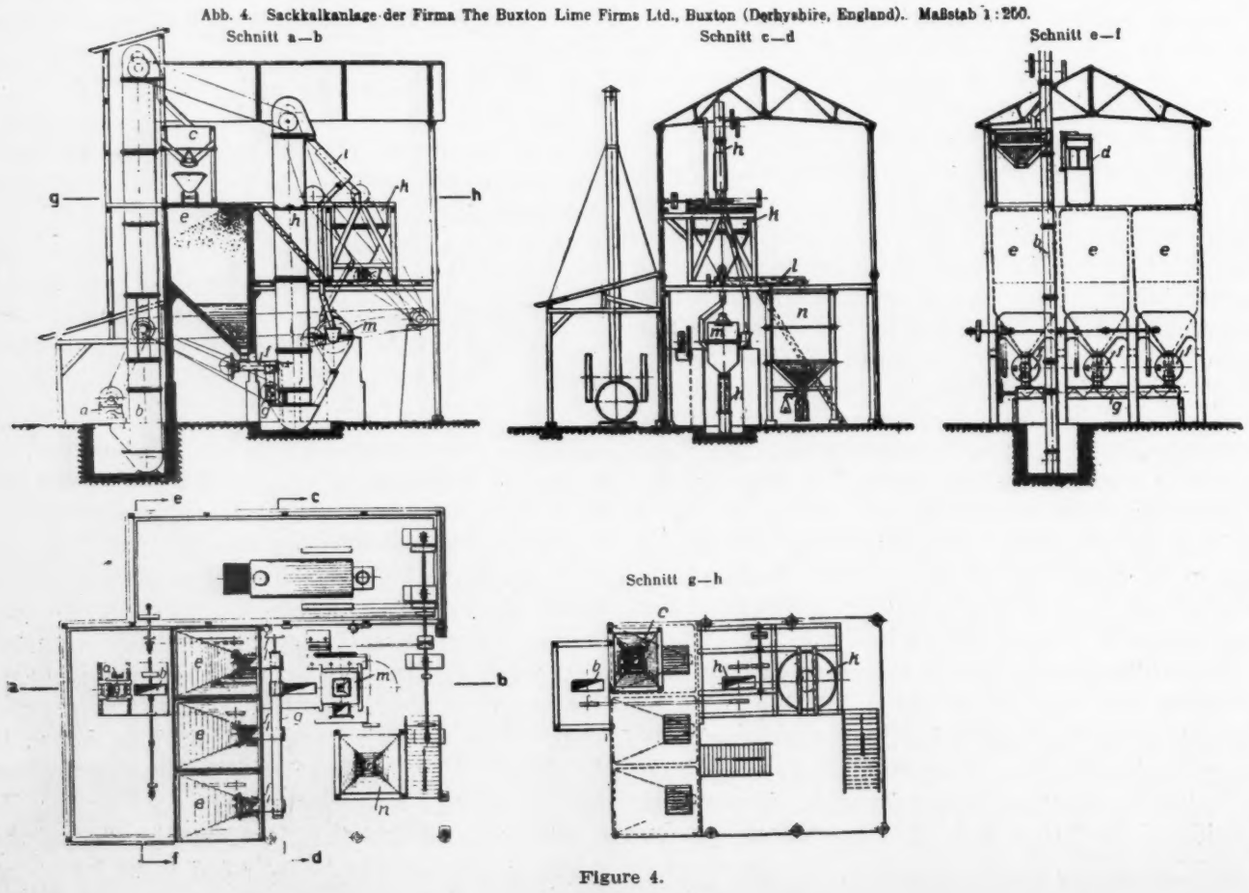


Figure 4.

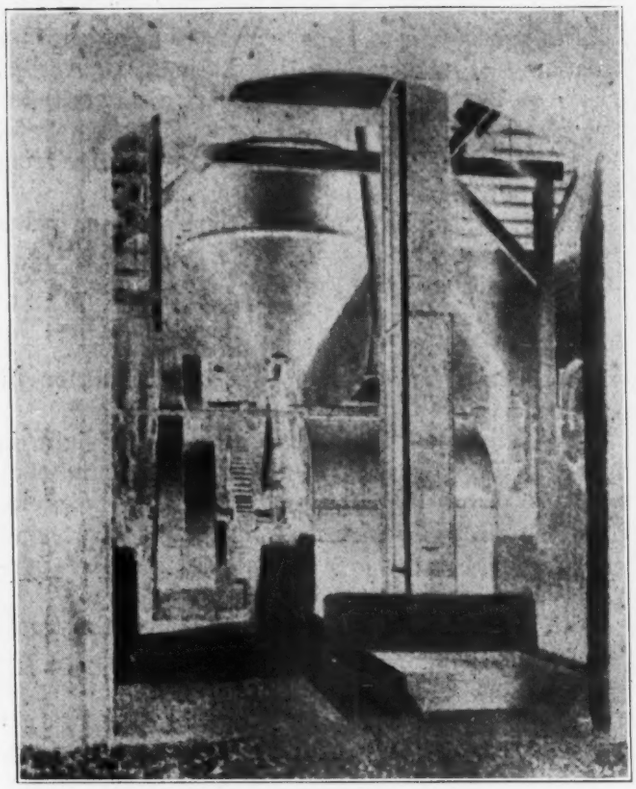


Figure 1.

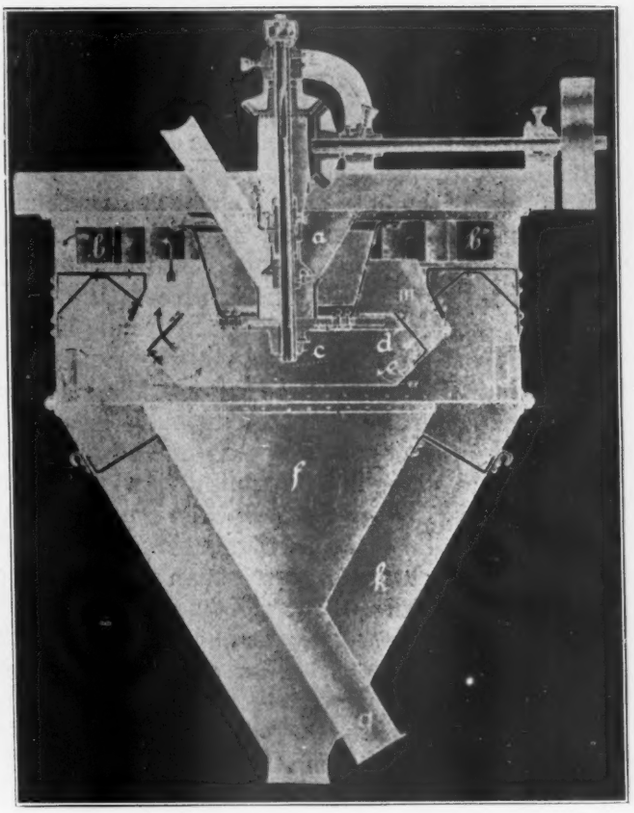


Figure 3.

out changing the rate of rotation, and it possesses strong parts resistant to wear and tear and is completely free from dusting. Figure 3 shows a section of this patented air separator.

Along the vertical axis there is arranged on top a fan "b" and at the bottom a distributing plate "c." The material fed in at "a" is thrown by centrifugal force outwardly toward the guide ring "d" attached to the distributing plate "c," from which it is again thrown toward the sheet-metal funnel "e." From this it falls vertically down toward the hopper for coarse material at "f." The air current induced by the fan passes across the charge to be separated in the direction indicated by the arrows in the figure and carries along the fine particles of the charge while the coarser portion falls into the hopper "f" and moves out along the discharge line "g." The air current entering the fan is blown by it along the cylindrical upper portion of the external separator space, and as a result of the larger volume between it and the inner separator space the air current decreases in velocity so that it is no longer able to carry the fines and as a result the latter is discharged downward in a spiral path into the fines hopper "k." Then the air current impinges against the sheet-metal baffles "i" as a result of which the separation is made easier. The fines leave the separator by the discharge opening "l." The air current freed from fines in the manner described is finally led horizontally under the distributing plate and the cycle of operations is repeated.

Once the speed of the fan is adjusted the degree of fineness of the grinding is also determined. After that small changes in fineness, if necessity for such arises in the course of operations, can be made very simply by adjusting the blades of the fan in a few minutes. A change in the peripheral speed of the distribution plate which would follow an adjustment of the number of revolutions is not to be recommended as a lighter material will not be thrown against the guide ring with the necessary force and therefore no sufficient separation would be obtained. With the air separator considered a completely sharp separation or sifting is obtained. Once the installation is made, careful watching is not necessary and a product is obtained of permanently uniform fineness. The life of such a separator is almost unlimited.

In connection with the above representation it might be advisable to describe a complete bagged-lime installation such as was delivered to the firm of "The Buxton Lime Firms, Ltd.," Buxton, Derbyshire, England, shown in Figure 4.

The lime, pre-crushed on the stone breaker "a," is supplied to the small silo "c" by means of the chain pump; from this silo the small tip-wagons are loaded with the crushed lime. These are then discharged into a basin "d" having a water supply pipe; when this is filled with lime it is sprayed with a carefully measured quantity of water. After the spraying the lime is forced into the slaking silo "e" from which it is removed by a worm "g" provided with a controlable emptying device "f" and from this it is transferred to the screenless Orion Mill by means of the chain pump "h." The grind-

ing procedure is then as has already been described. The finished product is then bagged from the silo "n" by means of an automatic sacking equipment.

In France methods of preparation are customary which are distinguished from these described above principally by the fact that several varieties of product are prepared from the burnt lime especially light lime (Chaux légère) heavy lime (Chaux lourde) and Grappier-Cements (natural cement). In this case the manufacturing process is as follows. In the first place the least hydraulic lime is removed from the moistened lime by means of an air separator. The still more or less undecomposed lime which remains in the residues is stored again and then crushed in a hammer mill or is freed from this lime in a ball mill with a small ball-drop. The lime which has now been freed is separated as heavy lime by a further separating process and is distinctly more hydraulic than the light lime first obtained. The Grappier-Cements are generally ground up immediately for the installation will become too complicated if an additional slaking were necessary. However, there is a whole series of intermediate processes. Often light and heavy lime are mixed and from them only one kind of hydraulic lime is prepared. In other words, the light lime is drawn off and the heavy lime and the Grappier-Cements are worked up together. As such works occasionally have calls for Grappier-Cements the operation of such plants is interrupted from time to time in order to take out separately the lime-free coarse sizes which have passed through the apparatus several times; this material is drawn off at the outlet of the separating equipment and is then ground up specifically. In practically all installations provisions are made to mix together light and heavy lime and Grappier-Cements in any proportion desired and to bag the product. In these installations by means of a simple hammer arrangement a hydraulic lime of any desired density can be obtained to meet the desires of the trade.

Making Employees Partners

Selling stock to employees in an effort to make them participating members in the organization is a policy that has become so widely adopted that today more than 3,200 industrial firms are giving their employees the opportunity to acquire stock on partial payment plans. Two great advantages are claimed for employee stock ownership, viz: The encouragement of thrift and systematic savings, and the increase of labor's interest in the success of the business.

Outstanding among the organizations encouraging employee stock ownership is the American Telephone and Telegraph Company, which concern now has a total of 57,000 shares with a market value of over 86 million dollars held by workers. Among other large corporations that have found this scheme to be of benefit are the meat packing companies, Standard Oil, International Harvester, Eastman Kodak, Bethlehem Steel, Proctor & Gamble, National Biscuit, several railway systems, etc. Employees' holdings in these companies range from 5 to 65 millions of dollars.

Broadly speaking, there are four accepted plans for encouraging such stock ownership:

1—Stock sold to workers at market value.

2—Stock sold at par.

3—Stock sold at a predetermined discount.

4—Stock given to employees in recognition of service.

The latter plan, that of giving stock outright, is not generally favored since it has been found that gifts are frequently misinterpreted by the workers, that the proposition smacks of paternalism, and that invariably the idea defeats its intended purpose. The other three forms are in wide use.

As for the details of the various plans, these may be classified somewhat as follows: 1—Eligibility requirements; 2—type of stock offered; 3—term of payment; 4—terms of redemption; 5—contribution by employers, if any; 6—other special provisions.

Some companies have no eligibility requirements, any worker being permitted to subscribe to the stock accumulation plan. Other companies require periods of prior service ranging from 2 months to 5 years, while a few establish a minimum salary requirement. Several firms fix a maximum amount, such as $2,000 as being the total obtainable under the employee stock-ownership plan.

Either common or preferred stock may be offered, a few companies offering its own bonds. With regard to the latter, however, it is common for the company to enter into arrangements with the underwriting concern, the bonds actually coming from the source. With a few companies, employees do not purchase actual stock but merely subscribe to certificates of ownership. Others hold the stock within the company by incorporating a clause in the purchase contract which compels the employee to sell back the stock at the time of discontinuance of service.

In the matter of payment, the usual practice is to deduct the partial payments from the earnings of the worker on the established pay-days. In some cases the deduction is $1 per share per week, while in the majority the amount to be deducted is optional with the worker, there being of course an established minimum.

The terms of redemption vary with individual companies. Usually, balances are returned, plus interest ranging from 4 to 7 per cent. It has become almost standard practice for firms to buy back in the same manner sold—either at par or at the market price. In quite a number of cases the firm contributes, merely as an incentive to purchase, a fraction of the amount paid in by the employee.

THE TEN PER CENT PROFIT PRINCIPLE

OVER the luncheon table recently we happened to be party to a discussion regarding profits in manufacturing enterprises. Because the expressions came from representative manufacturers and economists a brief quotation will be made from our conversation:

Said Manufacturer A: "I make 10 per cent on my invested capital, and in my opinion that should be sufficient for any manufacturer."

B, turning to C: "What shall we do with him? Hang him at sunrise?"

C: "No, let him alone. He'll hang himself."

A: "Why that? You know, don't you, that the government will take in excess profits tax everything I make over and above 10 per cent? I am not working for the government!"

C: "Well, I wouldn't say 'everything over and above,' but I will say that had it not been for the prevelant but utterly fallacious idea of profits on that part of manufacturers, the government would not be imposing this 'excess profits' business. The profit ideals of manufacturers in general have been too low for many years, and because our government merely represents ourselves, our low ideals are reflected in government action. You, speaking generically, brought this bugaboo upon yourself. Had you realized the necessity for making sufficient profit to enable you to put back into your business at least 10 per cent a year, you would not now be cursing this harmful 'excess profits tax,' the very nomenclature of which stamps it as being something which should not exist."

Isn't there much that is worthy in the remarks of "C." Is there not logic in the contention that the policy of using invested capital as the sole basis for determining profits is utterly fallacious? If there be no logic there, then why shouldn't doctors, dentists, architects, and other professional men base their fees on the amount of "invested capital"—schooling, equipment, books, etc.

This 10 per cent standard is a very common one, and all too often is based on deflated values. One concern may have had land, and even buildings, donated by an ambitious community merely to encourage the establishment of the enterprise in their midst. Not infrequently, equipment and machinery are obtained at receiver's sales and at prices far below their actual values or original purchase price. Ten per cent on these depressed surface investments often results in ridiculously and dangerously narrow profit margins.

The habit of comparing profits with the amount of capital invested is utterly without a sound premise. One firm may use executive ability where another must use invested capital. The inventories of one may represent only 30 days' sales requirements, while a competitor, equally efficient and well managed, must tie up a 6 months' stock. One firm will turn its capital twice as fast as will another merely because of different policies. One may sell for cash only, with restricted, high-grade business as a result, while a competitor may cater to the credit class and encourage extension of business through long term contracts. One company may own all sources of raw material, while the second firm may be largely an assembling plant.

Obviously, the establishment of 10 per cent, or any other common ratio, upon capital invested, must penalize ability. To earn only 10 per cent on invested capital when second hand equipment is used (adequacy of which is made possible by intelligent effort and direction) fails to allow for the return value of such intelligence.

Manufacturing as an investment proposition suffers small favor largely because the profit ideals of the majority are too low to permit of adequate, certain returns. Investors in stocks demand odds of 2½ to 1, since manufacturing stock is regarded as only 40 per cent as desirable as merchandising stock. Abandon the fallacious 10 per cent on invested capital principle and calculate prices so as to assure both a reasonable expansion of enterprise and an adequate, year after year, profit and manufacturing will assume its rightful place in the investment field. "Profits" are earnings capable of distribution as dividends—not frozen surplus, increase in value of shares, or reserves. Ten per cent on invested capital is, generally speaking, only enough to keep the enterprise in logical growth. If profit margins could be broadened to permit the reinvestment of the existing 10 per cent, then the regular payment of a reasonable return (at least in all but very subnormal years) there would be fewer ambitious and aggressive employees seeking to part company with the parent organization with the intention to start a rival concern, a larger investment demand for industrial stocks would be created, greatly reduced mortality in manufacturing enterprises would be effected, and healthier conditions in general would be assured.

Building Construction Outlook Good

"Building construction for the first half of 1927 should continue at approximately the same pace that has been displayed in the closing months of 1926, during which period there has been slight decrease," according to S. T. Straus, senior, vice-president of S. W. Straus and Company. From indications it is reasonably safe to state that over the country generally, building operations will continue during the coming year in such volume as to be a mainstay of national prosperity, he asserts. The view of Mr. Straus is substantially supported by other leaders in the building industry.

Some Stone Crushing Needs

By A. O. Deringer

The remark is sometimes made that there are not as many opportunities nor as many needs for new inventions today as there were fifty or even twenty-five years ago. However, this is not the case, every industry needs improved methods in order to produce better and cheaper.

Though we have experienced and come to appreciate many useful and beneficial inventions within the past decade, we must not lose sight of the fact that each new invention creates a demand and a need for scores of other improvements. As an example, no doubt the time will come when automobiles and airplanes will be propelled by other power than that furnished by the gasoline motor, and houses will be lighted without being connected to a power line.

The stone industry can boast of its share of mechanical inventions that have enabled producers to meet the growing demand for their product in greater volume and at less cost. Yet, notwithstanding these improvements in the stone industry and the many modern constructed crushing plants, there is still room and a great need for further improvement in the production of commercial stone.

A producer of this product, whose capacity is in the neighborhood of 2,500 to 3,000 tons per day, will require an array of secondary units, if his entire output must be converted into the smaller aggregates, unless he is fortunate enough to have a market that will take practically the entire output of his primary crusher at its maximum capacity. But this requires a costly installation and expensive operation and also tends to retard the output.

Some manufacturers of crushing machinery claim to have solved the problem of reducing stone of steam shovel size to the desired commercial sizes in one operation. However, though they have been able to do this, to some degree, it has been at a sacrifice of the maximum capacity of the equipment and then only to a limited daily tonnage. Therefore, there is great need of a machine that will reduce steam shovel size stone to any desired sized product the trade may demand and do it in one operation, and yet maintain the machine at full rated capacity.

Then too the demand for a cleaner and more uniform product is becoming more prevalent, so that the need for better screening equipment, capable of handling large column tonnage and at the same time deliver a clean uniform product is greatly felt. The present universally used screening system, while a simple and capable arrangement, is not conducive to producing a maximum clean product unless a large amount of screening equipment is installed.

While the above enumerated needs are among the most important there are others that are becoming felt, and it seems apparent that before another decade the present method of producing stone will be considered very old fashioned and more costly than the new improved methods which will be developed.

Employment Department Functions

1. To number all positions and list the qualifications for each.
2. To find, analyze scientifically, and recommend for employment all the workers needed in the work to which they are best adapted.
3. To secure for all positions the very best human material obtainable.
4. To outline the readjustment of the workers employed so as to secure the best results.
5. Gradually to eliminate the unfit and place those retained where they will be the least objectionable.
6. To take steps to secure applications from desirable men not at present obtainable or particularly needed and to analyze and list these as a reserve or source of supply.
7. To keep accurate records of the deportment and performance of every man
   (a) As a check on efficiency of the employment department,
   (b) As a means of dealing with the man himself.
   (c) As a means of determining the trend of the whole organization.
8. To investigate, consider, and bring up for adjustment all cases of inefficiency, discontent, lack of harmony, and misunderstanding.
9. To establish a minimum wage rate for each position or secure the best human material obtainable for each position at as low a rate as possible commensurate with justice to employer and employe.
10. To make known the ideals of the organization to the employes.
11. To familiarize each worker with the qualities considered to be ideal for his job and then to inspire him to strive for their attainment.
12. To form classes among executives, superintendents, and foremen for inspiration, suggestion, and instruction.
13. To determine and render available as far as possible all the latent genius and special abilities of employes.
14. To instil into every individual the desire to cooperate.
15. To select and educate understudies for every position of importance.

National Crushed Stone Association Convention

Tentative Program

January 17, 18, 19 and 20, 1927

Monday, January 17, 1927

Morning Session, 10:00 A. M.

Otho M. Graves, Presiding

10:00 Address of Welcome by Hon. John Smith, Mayor of Detroit.

10:15 Response for the Association and Presidential Address, Otho M. Graves.

11:00 Appointment of Convention Committees:
- Rules and Procedure
- Resolutions
- Nominating
- Auditing
- Entertainment
- Reception
- Publicity

11:15 Reports of Directors on Business Conditions in 1926 and the Outlook for 1927.

12:45 to 2:00 P. M. Get-Together Luncheon. Everyone, including active and associate members, as well as guests, is cordially and earnestly invited to attend.

Luncheon Address—"Ideals in Trade Associations"—John N. Van der Vries, Manager Northern Central Division, U. S. Chamber of Commerce.

Monday, January 17, 1927

Afternoon Session

2:30 "Progress of Bureau of Engineering"—A. T. Goldbeck, Director.

3:00 "Crushed Stone for Sewage Disposal and Water Purification Work"—William E. Stanley, Pearse, Greeley & Hansen, Chicago, Ill.

3:30 "The Use of Crushed Stone in Intermediate Type of Road Construction"—C. N. Conner, Chairman, Low Cost Improved Road Investigation, Highway Research Board.

4:00 General Business.

4:30 Adjournment.

Monday Evening, 7:30 P. M.

Opening of Manufacturers' Division Exposition of Quarry Equipment and Machinery

9:30 Smoker and Entertainment.

Tuesday, January 18, 1927

Morning Session

10:00 "Agstone Situation in Illinois"—J. R. Bent, Farm Supply Department, Illinois Agricultural Association.

10:30 "The Super Highway and Its Part in Detroit's Master Plan"—Col. Sidney D. Walden, Chairman, Detroit Rapid Transit Commission.

11:00 "Bituminous Road Construction"—R. W. Coburn, Construction Engineer, Department of Public Works, Boston, Mass.

11:30 "Some Modern Developments in Bituminous Road Construction and Maintenance"—K. E. McConnaughay, Hayes Construction Co.

12:00 Discussion by George E. Martin, Consulting Engineer, The Barrett Company.

12:20 "Bituminous Macadam Construction"—G. H. Henderson, Chief Engineer, State Board of Public Roads, Providence, Rhode Island.

12:50 General Business.

1:00 Adjournment.

Tuesday, January 18, 1927

Luncheons

1:00 to 2:00 Luncheon for Operating Men, Superintendents and Manufacturers followed by joint meeting of these groups, inspection of exposition and subsequent sightseeing trip through City.

Luncheon for Salesmen, with subsequent meeting, Harry H. Brandon, presiding.

Talk on "Sales," by Charles Henry Mackintosh.

Luncheon National Agstone Association, with subsequent meeting—L. E. Poorman, President, presiding.

Address by Dr. Herbert F. Kriege.

Tuesday, January 18, 1927

Evening

Theatre Party.

Wednesday, January 19, 1927

Morning Session

10:00 "Stone Dust, Its Use and Preparation"—W. M. Weigel, Mineral Technologist, Missouri Pacific Railroad.

10:30 Address by Charles M. Upham, Business Director, American Road Builders' Association.

11:00 "The Value of a Transport Survey—G. F. Schlesinger, Director of Highways and Public Works, Columbus, Ohio.

11:30 "Michigan Roads"—Frank F. Rogers, State Highway Commissioner, Michigan State Highway Department.

12:00 "The Use of Crushed Stone in the Manufacture of Concrete Products"—W. D. M. Allan, Portland Cement Association.

12:30 "Commercial Sizes of Broken Stone"—F. H. Jackson, Engineer of Tests, Bureau of Public Roads, Washington, D. C.

1:00 Adjournment.

Wednesday, January 19, 1927

Afternoon

1:00 to 2:00 Group Luncheons:
- Highway
- Salesmen
- Superintendents
- Agricultural Limestone
- Concrete Aggregate and Ballast
- Manufacturers' Division

2:00 to 5:30 Inspection trip Ford automobile plant for everyone.

Wednesday Evening, 7:00 P. M.
Annual Banquet

Toastmaster—(not determined).

Speakers—A. J. Brousseau, President, Mack Trucks, Inc.; Frank T. Sheets, Chief Highway Engineer, Division of Highways, Illinois (Two other speakers not as yet determined).

Thursday, January 20, 1927
Morning Session

10:00 "Winter Storage of Stone"—W. R. Sanborn, Lehigh Stone Company.

10:15 Address on Safety Work—Speaker not yet determined.

10:45 Address by W. J. McGarry, Car Service Division, American Railway Association.

11:15 "Installation of Laboratory of France Stone Company, Its Purpose and Program"—A. C. Avril, Mining Engineer, France Stone Co.

11:30 "Field Testing of Concrete for Concrete Roads"—H. F. Clemmer, Wing & Evans, Inc.

12:00 Report of Committee on Welfare and Safety—N. S. Greensfelder, Chairman.

12:15 "Research as an Aid to Safety and Efficiency"—Dr. Oliver Bowles, Supt. U. S. Bureau of Mine Experiment State, New Brunswick, N. J.; D. C. Souder, The France Stone Company; E. E. Evans, The Whitehouse Stone Company.

12:30 Report of Committee on Rules and Procedure:
Report of Auditing Committee
Report of Resolutions Committee
Report of Committee on Nominations

12:50 Installation of Officers for 1927.

1:00 Adjournment.

1:00 General Get-Together Luncheon.

Thursday, January 20, 1927
Afternoon

2:30 Meeting Board of Directors and Officers N. C. S. A.

2:30 Meeting Manufacturers' Division.

List of Exhibitors

The following is a complete list of companies that have reserved space up to December 30th for the machinery exhibit which will be held in conjunction with the Tenth Annual Convention of the National Crushed Stone Association:

Hercules Powder Company, Wilmington, Del.

Keystone Division, McGraw-Hill Publishing Co., 800 Pennsylvania Ave., Pittsburgh, Pa.

Manganese Steel Forge Co., Richmond St. and Erie Ave., Philadelphia, Pa.

Loomis Machinery Co., Tiffin, Ohio.

Rock Products, 542 S. Dearborn St., Chicago, Ill.

Marion Steam Shovel Co., Marion, Ohio.

Hendrick Manufacturing Co., Carbondale, Pa.

Burrell Engineering and Construction Co., 513 W. Jackson Blvd., Chicago, Ill.

Williams Patent Crusher & Pulverizer Co., 813 Montgomery St., St. Louis, Mo.

Tredick Oil & Grease Co., 2642 N. Mascher St., Philadelphia, Pa.

Blaw-Knox Company, P. O. Box 915, Pittsburgh, Pa.

The Jeffrey Mfg. Co., Clumbus, Ohio.

The W. S. Tyler Co., Cleveland, Ohio.

Pit and Quarry, Rand McNally Bldg., Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Columbus McKinnon Chain Co., Fifth and Merrith Sts., Columbus, Ohio.

The Grasselli Powder Co., Cleveland, Ohio.

The Fate-Root-Heath Co., Plymouth, Ohio.

E. I. du Pont de Nemours Co., Wilmington, Del.

Robins Conveying Belt Co., 15 Park Raw, New York City.

Sanderson-Cyclone Drill Co., Orrville, Ohio.

Symons Brothers Co., 111 W. Washington St., Chicago, Ill.

Cement, Mill and Quarry, 542 Monadnock Block, Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

General Electric Co., Schenectady, N. Y.

Geo. D. Whitcomb, Rochelle, Ill.

Heisler Locomotive Works, Erie, Pa.

Keystone Lubricating Co., Philadelphia, Pa.

The Bucyrus Co., South Milwaukee, Wis.

Western Wheeled Scraper Co., Aurora, Ill.

Allis-Chalmers Co., Milwaukee, Wis.

Osgood Co., Marion, Ohio.

United States Bureau of Mines, Washington, D. C.

Smith Engineering Works, Thirty-second and Locust Sts., Milwaukee, Wis.

National Safety Council, 108 E. Ohio St., Chicago, Ill.

Harnischfeger Sales Corporation, Thirty-eighth and National Aves., Milwaukee, Wis.

Easton Car & Construction, Easton, Pa.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Hayward Company, 50 Church St., New York City.

National Crushed Stone Association, 651 Earle Bldg., Washington, D. C.

Traylor Vibrator Co., 1400 Belgany St., Denver, Colo.

Koppel Industrial Car & Equipment Co., Koppel, Pa.

Flexible Steel Lacing Co., 4607 Lexington St., Chicago, Ill.

R. H. Beaumont Co., 319 Arch St., Philadelphia, Pa.

NATIONAL SAND AND GRAVEL ASSOCIATION CONVENTION ARRANGED TO INSURE SUCCESSFUL MEETING

The eleventh annual convention of the National Sand and Gravel Association will be held in Cincinnati, Ohio, on January 17, 18 and 19, 1927. The first day of the convention will be devoted mainly to the annual meeting of the Board of Directors of the Association. Many matters will be presented at this time for their consideration, involving things which are connected with the progress of the industry.

On the second day, the convention opens formally. Fred Hall, chairman of the convention committee, will introduce Hon. Murray Seasongood, Mayor of Cincinnati, who will welcome the visitors to the city. Then President Haddow of the Association will take the chair and will present Professor Duff A. Abrams to those in attendance who has chosen for his subject the "Importance of Industrial Research." Following Professor Abrams' address the report of the Board of Directors will be submitted to the convention as a whole for approval, after which the meeting will adjourn.

At the afternoon session the first speaker will be W. J. McGarry, Manager, Car Service Division, American Railway Association. Mr. McGarry has chosen for his subject "Transportation Conditions Affecting the Sand and Gravel Industry." F. J. Stimson, Chief Engineer of the Pennsylvania Railroad, will follow Mr. McGarry, his talk being devoted to the use of washed gravel as railroad ballast. Mr. Stimson is prominently identified with the American Railway Engineering Association and his remarks will, no doubt, be of great interest to the industry. After Mr. Stimson will come Edwin Brooker, Commerce Counsel of Washington, D. C., who will discuss the "Value of Sand and Gravel to the Carriers from a Revenue Standpoint." C. R. Stokes, Manager, Highway Department, National Lime Association, will conclude the first day's session.

At the opening of the program for the last day of the convention arrangements have been completed to bring before the convention three authoritative and experienced designers of sand and gravel plants. Those who will take part in this "Symposium on Plant Design" are F. M. Welch, of the F. M. Welch Engineering Service; Gordon Smith of the J. C. Buckbee Company, and Albert E. Reed of the W. S. Tyler Company. The latter's paper being particularly with reference to the application of vibrating screens to sand and gravel operations. These three talks will be of importance to plant owners and superintendents and others interested in plant equipment and its use.

Many other outstanding features will be at the meetings and contribute to the success of the convention. Among other speakers who will appear are A. S. Rea, Engineer of Tests, Ohio Highways and Public Works Department; Professor R. L. Morrison, Director, State Highway Laboratory of Michigan; Judge W. A. Hough of the Indiana Highway Department.

Stanton Walker, Director of the Engineering and Research Division, National Sand and Gravel Association, will deliver a paper and will also demonstrate tests which sand and gravel producers are able to make at their plants. Stephen Stepanian will deliver his report as Chairman of the Committee on Standardized sizes for sand and gravel of the National Association. Further attractions will be the machinery exhibit and the entertainments which have been arranged for the visitors.

List of Exhibitors

The following is a complete list of companies that have reserved space up to December 30th for the machinery exhibit which will be held in conjunction with the Eleventh Annual Convention of the National Sand and Gravel Association:

Allis-Chalmers Manfuacturing Company, Milwaukee, Wis.

American Manganese Steel Company, Chicago Heights, Ill.

Barber-Greene Company, Aurora, Ill.

R. H. Beaumont Company, Philadelphia, Pa.

Blaw-Knox Company, Pittsburgh, Pa.

Brown Hoisting Machinery Co., Cleveland, Ohio.

Cement, Mill and Quarry, Chicago, Ill.

Cincinnati Rubber Manufacturing Co., Cincinnati, Ohio.

Climax Engineering Company, Cleveland, Ohio.

The Dorr Company, New York, N. Y.

Eagle Iron Works, Des Moines, Ia.

Fairbanks, Morse and Company, Chicago, Ill.

Farrell-Cheek Steel Foundry Co., Sandusky, Ohio.

Fate-Root-Heath Company, Plymouth, Ohio.

Gifford-Wood Company, Chicago, Ill.

F. W. Welch Engineering Service, Greenville, O.

C. Taylor Handman Company, Cincinnati, Ohio.

The Hayward Company, New York, N. Y.

Hendrick Manufacturing Company, Carbondale, Pa.

A. Leschen & Sons Rope Company, St. Louis, Mo.

Link-Belt Company, Chicago, Ill.

Martin-Parry Corporation, Norwood, Ohio.

Mid-West Locomotive Works, Cincinnati, Ohio.

The Morrow Manufacturing Co., Columbus, Ohio.

New Jersey Wire Cloth Company, Trenton, N. J.

The Osgood Company, Marion, Ohio.

Perfect Classifier Company, Nashville, Tenn.

Pit and Quarry, Chicago, Ill.

Rock Products, Chicago, Ill.

Sauerman Bros., Inc., Chicago, Ill.

Symons Brothers Co., Milwaukee, Wis.

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

The W. S. Tyler Company, Cleveland, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.
G. H. Williams Company, Erie, Pa.
Niagara Concrete Mixer Company, Buffalo, N. Y.
The Webster Manufacturing Company, Cincinnati, Ohio.
Stephens-Adamson Manufacturing Co., Aurora, Illinois.

Diamonds Used in Drilling

Most of the black diamonds or "carbonados," usually called carbon, which are used in diamond drilling come from the State of Bahia, Brazil, though some are also found in the State of Minas Geraes, according to the Bureau of Mines, Department of Commerce. They occur in gravel or conglomerate beds, which occur over a large area in these two states, and in beds of streams which have cut through the surface formations. Although they have been found in Borneo, they have been mined only in Brazil.

Black diamonds range from stones of microscopic size to those weighing several hundred carats. The largest stone ever found was irregular in outline and about the size of a baseball. The average size of black diamonds, as found, is probably 5 to 10 carats. They are bought direct from the native miners by brokers or by representatives of the carbon houses. The black diamond is one of the rarest and most interesting of minerals; its chemical composition is exactly the same as that of the white stone, and its specific gravity ranges from 2:75 to 3.45. It is the hardest and toughest substance known. It is just as hard as the white diamond, which stands at the top of the scale of hardness, and is much less liable to fracture.

Black diamonds are mined by native labor. Improved machinery and mining methods may increase the recovery from the known fields. It is probable that large known diamond-bearing areas in Brazil have not been thoroughly worked; in view of this fact, it is believed there is little danger of a black-diamond shortage. Black diamonds in their natural forms seldom have the size and shape suitable for diamond-drill work, and therefore must be broken before they can be marketed. Breaking diamonds requires judgment and skill. The skill is shown by the way a workman breaks a large stone to get the greatest number of stones of the right size and shape. Approximately 20 or 25 per cent of the stone is lost in breaking.

The bort, which is often used as a substitute for the black diamond, is an imperfect gem stone or white diamond. It is fully as hard as the black diamond, but is a single crystal and fractures more readily. Borts may prove a good substitute for black diamonds in oil drilling, where the formations are comparatively soft and the danger of breaking the stones is consequently much less than in hard formations. However, operators who have tried borts for coal prospecting have almost invariably found that black diamonds were more economical. It may be cheaper to use second grade black diamonds for oil-field drilling than to use borts, which normally sell for about 60 to 80 per cent of the price of first-grade black diamonds.

A great many artificial substitutes for black diamonds have been suggested, but as yet, with one exception, none has proved satisfactory. Any artificial substance that has the necessary hardness is crystalline and therefore easily broken along its cleavage planes. Possibly some of the aluminum oxides, such as alundum, may have the required properties.

The number of stones needed for a bit depends on the size of the bit. The small bits used in drilling for ores are ordinarily set with six stones, although as few as two stones have been used. Large bits used in Europe for drilling large holes contain 40 to 50 stones. For ordinary oil-field work the bits will probably require 6 to 16 stones. The stones used in metal prospecting ordinarily weight 3 to 4 carats each, they have ample cutting surfaces and enough body to let them be firmly fastened in the metal of the bit. Stones of this size should not project more than one thirty-second inch beyond the outside of the metal. When mud fluid is used with the diamond drill, larger stones which will project farther out from the face of the bit will probably be needed. In this event the stones that will be used in oil-field work may weight 7 to 10 carats. Stones weighing more than 5 or 6 carats are not readily marketable at present and can therefore be obtained at a lower price per carat than the smaller stones.

Information in regard to the operation of diamond drills, with special reference to oil field prospecting and development, is contained in Bulletin 243, by Frank A. Edson, copies of which may be obtained from the Bureau of Mines, Department of Commerce.

Old Talc Mines to Be Opened

Word has been received recently that the talc mines in Moore County, North Carolina, near Glendon, will be worked again following their purchase by a new corporation for which a charter has been issued by the state.

The United Talc and Crayon Company, new owners of the mines, situated on a property consisting of approximately 100 acres, plans to operate the mines on an extensive scale.

Instead of shipping the products to other markets for use in production of various manufactured products, it is the plan of the new firm to use the talc for articles to be produced in North Carolina. Soapstone pencils and tailors' chalk will be made of the talc. Iron workers are among the chief users of the pencils, while the chalk is used extensively as a tailor's guide in cutting cloth.

AMERICAN ROAD BUILDERS CONVENTION

The 24th Annual Convention of the American Road Builders' Association will be held in Chicago, January 10th to 14th, inclusive, President Shirley has set aside the first day of the convention, January 11, as Governors day. At 10 o'clock the general session will meet in the grand ball room, Palmer House, at which addresses will be given by Honorable Len Small, Governor of Illinois, Honorable Wm. E. Dever, Mayor of Chicago and Thomas H. MacDonald, Chief U. S. Bureau of Public Roads. A number of papers will be read at other meetings during the day.

The second day, January 12, has been designated as Pan-American day. At the general session, 10 A. M., Mr. Diaz Leal, Mexico, and Mr. R. Keith Compton, will preside. During this meeting addresses will be given dealing with Canada's highway problem, the highway situation in Mexico, Chilean policy of road construction, maintenance and finance, and road construction in Cuba. Two sessions will be held simultaneously at 2:00 in the afternoon. One devoted to engineers' problems and the other devoted to construction problems. At each of these gatherings papers will be read and discussed, dealing with subjects of particular interest to the division attending. In the evening the Road Builders' Annual banquet will be held in the Grand ball room, Palmer House, commencing at 7:00 P. M.

The third day is to be known as States' Day. Dr. Fons Hathway, Chairman of the Florida State Highway Commission, has been appointed chairman of this committee. Many of the states will have exhibits and the states will be represented by a large number of representatives. During this day meetings will also be held in the Palmer House and interesting addresses will be given and papers presented dealing with Engineers and Constructors problems. The final general session will be held in the afternoon at 2:00 P. M. in the Palmer House. Each day during the day the "Highwayman" will be published. This paper will be in charge of Mr. R. M. Arundel. It will contain the convention program, a list of the daily events and other items of interest to those attending, and will be distributed free of charge at the convention and road show.

The Road Show will break all previous records. There will be more than 300 car loads of equipment, valued at more than $3,000,000 on exhibition. Gigantic cranes, steam shovels, mixers and all other machinery used in the construction of modern highway will be on display at the Coliseum Annex, Greer and Wilson buildings. The exposition will be a true cross section of the Highway industry, and those interested in any of the branches of construction, maintenance or operation will find the latest developments and improvements on display.

The program to date is as follows:

Tuesday, January 11, 1927
General Session
The Governors' Day
Tuesday Morning at 10:00
Grand Ball Room, Palmer House

Presiding—Mr. Henry G. Shirley, President American Road Builders' Association Chairman, State Highway Commission of Virginia.

Opening Address by the President.
Honorable Len Small, Governor of Illinois.

Addresses by:
Honorable Wm. E. Dever, Mayor of Chicago.
Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads.

Tuesday, January 11, 1927
Engineers' Problems
Tuesday Afternoon at 2:00
Grand Ball Room, Palmer House

Presiding—Mr. George F. Schlesinger, Director, Ohio Department of Highways and Public Works.

General Subject—Work Preliminary to Construction

Ultimate Highway Developments, Widening Trunk Lines vs. Adding Parallel Highways.
Ben H. Petty, Assistant Professor of Highway Engineering, Purdue University, Lafayette, Indiana.

Economic Selection of Type.
H. E. Breed, Consulting Engineer, New York City .

Local Highway Development.
Colonel Woolsey Finnell, Probate Judge, Tuscaloosa, Alabama.

Load Factor as an Element in Design.
T. Warren Allen, Chief, Division of Control, U. S. Bureau of Public Roads, Washington, D. C.

Tuesday, January 11, 1927
Constructors' Problems
Tuesday Afternoon at 2:00
Red Lacquer Room, Palmer House

Presiding—Mr. Alan J. Parrish, President, Illinois Association of Highway and Municipal Contractors.

General Subject—Contracting as a Business
Contractor and Constructor Defined.

J. H. Ellison, President, Associated General Contractors of America, Vice-President, Winston-Dear Company, Minneapolis, Minnesota.

Profit in Industry.

H. A. Wheeler, Vice-President, Union Trust Company, Chicago, Illinois; Former President, United States Chamber of Commerce.

What Is a Fair Profit in Highway Construction?

Mr. George Drake, Johnson, Drake & Piper, Minneapolis, Minnesota.

Summary of Observations.

E. A. St. John, President, National Surety Company, New York City.

Wednesday, January 12, 1927
General Session
Pan-American Day
Wednesday Morning at 10:00
Grand Ball Room, Palmer House

Presiding—Mr. Diaz Leal, Mexico.

Presiding—Mr. R. Keith Compton, Director, Department of Public Works, Richmond, Virginia.

Canada's Highway Problem.

E. A. James, Chief Engineer, Toronto and York Roads Commission, Toronto, Canada.

The Highway Situation in Mexico.

Mr. Andres Orttis, Department of Communication, Mexico, D. F.

Chilean Policy of Road Construction, Maintenance, and Finance.

Mr. Benjamin Gonzalez Cohen, Secretary to the Chilean Embassy and formerly of the Public Works, Division of the Government of Chile, Santiago.

Road Construction in Cuba.

Mr. Manuel Alberto Coroalle, Construction Engineer for the Cuban Department of Public Works, Havana, Cuba.

Tentative acceptances have been made by Argentine, Peru and Santa Domingo to delegate Engineers to present papers.

Wednesday, January 12, 1927
Business Meeting
4.30 P. M.
Palmer House
Road Builders' Annual Banquet
Grand Ball Room, Palmer House
7:00 P. M.
Wednesday, January 12, 1927
Constructors' Problems
Wednesday Afternoon at 2:00
Red Lacquer Room, Palmer House

Presiding—Mr. Edward McGrady, President, Associated Pennsylvania Constructors, Harrisburg, Pennsylvania.

General Subject—Practical Operating Methods

Estimating and Cost Accounting for Highway Construction.

R. C. Jacobs, President, Juinata Paving Company, Philadelphia, Pennsylvania.

Value of Engineering Representation in Contracting Organizations.

W. M. Wilmore, Vice-President, Wabash Construction Company, Vincennes, Indiana.

State Versus Contractor's Control of Material.

Do Contractors Charge Equipment Rental Sufficient to Pay the Interest on the Investment, Operating and Replacement?

C. A. Eichelberger, Equipment Engineer, Pennsylvania Department of Highways, Harrisburg, Pennsylvania.

Wednesday, January 12, 1927
Engineers' Problem
Wednesday Afternoon at 2:00
Grand Ball Room, Palmer House

Presiding—Mr. Cyrus S. Avery, Chairman, Oklahoma Department of Highways.

General Subject—Construction

Latest Improvements in Construction Methods.

B. H. Piepmeier, Chief Engineer, Missouri State Highway Commission.

Contract Control and Engineering Service.

Leslie R. Ames, Acting State Highway Engineer, North Carolina State Highway Commission.

Control of Materials and Results.

H. S. Mattimore, Engineer of Tests and Materials Investigation, Pennsylvania Department of Highways.

Best Method of Control and Payment for Pavement Quantities.

F. E. Kelly, Acting Chief, Division of Tests, Bureau of Public Roads.

Thursday, January 13, 1927
Constructors' Problems
Thursday Morning at 10:00
Red Lacquer Room, Palmer House

Presiding—Mr. W. J. Wilkinson, President, Northern California Chapter, Associated General Contractors of America, San Francisco, California.

General Subject—Enlargement of Contractors' Field Benefiting Political Subdivisions

Is the Contractor's Loss a Public Gain?

Robert B. Brooks, Director, Streets and Sewers, St. Louis, Missouri.

Economic Waste in Construction of Public Work by Day Labor.

General R. C. Marshall, General Manager, Associated General Contractors, Washington, D. C.

Benefits of Highway Contractors Associations to the Contractor, Political Subdivisions and the General Public.

William F. Lodge, Contractor, Former President, Illinois Association Highway and Municipal Contractors, Monticello, Illinois.

PLANT LUBRICATION

By A. W. Friend

Part II

The first part of this article appeared in the December 22nd number of Pit and Quarry. The author discussed in Part I friction, lubrication of electric motors, lubrication of screw bearings, lubrication of gearing, chains and wire rope and conveyor belt idlers. This article was presented in the form of a paper before the Eighth Annual Meeting of the Wisconsin Mineral Aggregate Association at Milwaukee, December 16, 1926.—Editor.

Lubrication of Crushers

From the outward appearance of a gyratory crusher, one might be led to believe that its lubrication was a very simple matter, but such is not the case, however, due to the peculiarity of its construction and the rough work that it is required to do. Its lubrication is a matter of considerable difficulty; not only are all the bearings exposed to a great deal of dust and dirt, but some of them carry tremendous loads and are occasionally exposed to very low temperatures.

I am not going to dwell on the subject of crusher lubrication—only in a brief manner—but there is one thing I am going to point out to you and that is the necessity for the selection of an oil for cold weather or winter use. It seems to me that very little attention has been paid to the selection of an oil suitable for winter use and I wonder how many of you gentlemen have ever considered the savings in dollars and cents that could be effected by using an oil of the cold tested variety.

The average run of crusher oils used during the summer months has a cold test ranging from 35 to 45 above zero and when we speak of cold test as applied to these oils, we mean that we have reached the limit of their fluidity at these temperature ranges. Now, what happens to these oils when the temperature goes down to the freezing point or below? The thing that happens to them is that they become more viscous as the temperatures drop and offer more resistance to the mechanism revolving in their mass.

Here is another case where the cost of operating crushers during winter months is higher than during the warmer periods and it is for this reason that nothing but low cold tested oils should be used for the lubrication of this class of equipment during the colder periods of the season. Oils suitable for the lubrication of these crushers can be obtained just as readily as those with a poorer cold test and the cost, even though it is slightly higher for this class of oils, will be offset in many instances by the savings effected in the power bill.

I have in mind a gravel plant that I visited during the early part of last winter where they had fires built under the Crushers in order to thin down the oil to a point where they could be started with an electric motor without the belt slipping off of the pulley and it was 25 minutes before they were able to turn this crusher over and then it was necessary to hold the belt on to the pulley by the use of a couple of two-by-fours. The strange part of the whole thing was this loss of time was considered a necessary evil. When I questioned the foreman of this plant how long this system of building fires under crushers had been going on, he told me that he had been connected with this establishment for eight years and they were building fires under the crushers every morning during the winter months long before he ever entered the employ of the company.

I do not feel that my paper wuold be complete duction standpoint but whatever it was it was money and time needlessly wasted. The selection of low cold tested lubricants for winter use cannot be overestimated when one takes into consideration the savings that are possible in electrical energy consumed through their use.

Steam-Shovel Engine Cylinders

I don not feel that my paper would be complete without saying something relative to the proper lubrication of steam cylinders, as well as the selection of the oil used for this purpose.

Steam cylinders are usually lubricated by the application of what is known as the mechanical force feed lubricator or through a hydrostatic lubricator and the selection of oil used in the lubrication of these cylinders would depend a great deal upon the steam pressure carried as well as the moisture value of the steam used.

The object of internal lubrication in a steam engine is, firstly, to form a lubricating film between the rubbing surfaces and this replaces the metallic friction with fluid friction as far as possible; secondly, to form an oil sealing film in order to prevent leakage of steam past the valves, pistons and gland packings.

Only by feeding the correct grade of high quality cylinder oil, especially selected to suit the operating conditions of the engine, applied in the correct manner, to the right place and in the right quantity, will the seam engine continue to operate at its highest efficiency and with a minimum cost of renewals and repairs. Perfect lubrication is, therefore, chiefly dependent on the methods of lubrication employed and the selection of the correct oil for each individual case.

If too much oil is used, lubrication under saturated steam conditions will not be any better than when the right quantity of oil is used; whereas if

too little oil be used, a satisfactory oil film will not be maintained between the frictional surfaces, so that not only will heavy friction and wear occur, but also excessive steam leakage.

If an oil too heavy in viscosity is used, it will not atomize readily, resulting in poor distribution and necessitating excessive consumption. Due to its heavy body, the fluid frictional losses will be higher than they need be and, if the steam carries over impurities to the engine, the use of such an oil will encourage accumulation of deposits, particularly under high pressure conditions.

If an oil too light in viscosity is used, it will readily atomize and distribute itself, but it will not be able to withstand the pressure between the rubbing surfaces; metallic contact will take place, resulting in excessive wear; therefore, in order to realize the best lubrication, it is not only necessary to select an oil that will meet the conditions in a very efficient and economical manner, but we must atomize this oil in order to realize perfect distribution which is so essential in good lubricating practice.

Insulating Oils and Their Purpose

I am not going to say very much about insulating oils because of the fact that there is too much technical data connected with them. I am going to tell you what these insulating oils are used for and why they are used.

Insulating oils are used in transformers, induction voltage radiators, lightning arrestors, oil circuit breakers, starting compensators and various types of oil switches. The most common and possibly the most effective method of cooling this equipment is by the use of an insulating oil, due to the fact that the oil acts not only as an insulating medium but a cooling medium as well, The oil must have a low viscosity so that it will circulate freely and, as a result, carry away as much of the heat as possible from the coils and other working parts.

A clean, properly refined insulating oil, will have a dielectric strength of 22,000 volts or more when tested by what is known as the A. S. T. M. method. If the apparatus which uses insulating oils is exposed to weather conditions, it must be of the cold tested variety in order to eliminate any possibility of the oil congealing. However, the cold test is not of the utmost importance, due to the fact that enough heat is usually generated in the apparatus to keep the oil fluid.

The flash and fire points should be high enough to eliminate the possibility of fire or explosion as electrical apparatus is apt to be subjected to overloads, which may cause excessive heat; therefore, the flash point of the oil would be well over the temperature limits of the apparatus.

Transformer and switch oils should be handled very carefully. They should never be stored in the weather. This is necessary to prevent possible leakage around the bung which would permit the entrance of water into the barrels. They should never be opened until needed for use.

Insulating oils are shipped perfectly dry, but, in storage, absorb enough moisture to materially lower their dielectric strength. Before refilling any apparatus with insulating oil care should be taken to see that the apparatus has been thoroughly cleaned and dried. The vessel used in transferring the oil should be carefully inspected to insure cleanliness and dryness. After the apparatus has been filled it should be allowed to stand long enough for the oil to permeate the immersed parts. The oil level should then be checked for the proper level and the apparatus tightly closed.

An oil testing 22,000 volts under the A. S. T. M. method contains about 1 drop of water and 8 quarts of oil. If the water content should be increased to 3 drops, the dielectric strength would be reduced to about 14,000 volts which is more than 30 per cent loss.

The amount of temperature rise in transformers is of great importance, due to the fact that the insulating material of the coils will withstand only comparatively low temperatures. The amount of overload permissible is specified by the manufacturer of the apparatus.

I really believe the best method to pursue in selecting an oil in transformers and other electrical apparatus, is to consult a qualified oil salesman or the lubricating engineer who services your plants. These gentlemen are usually thoroughly familiar with insulating oils and their application and can assist you in the selection of the proper oil for each piece of equipment.

I have not covered the subjects in this paper as thoroughly as I would have liked, for, as I said before, time will not permit me to do so. However, I hope that you will, at least, find something of value in the suggestions that I have had to offer which will enable you to keep your friction losses at the lowest point possible and, by so doing, reduce your maintenance cost and the consumption of electrical energy, as well as the ton or yard of material handled.

In the Dan River Section of Stokes and Rockingham Counties, North Carolina, are important outcrops of Triassic shales suitable for brick and sewer pipes. The largest sewer pipe plant in the South, located at Pomona, is drawing its shale from this area and from the Sanford area.

Based on the rate at which new operations are being announced throughout the country, the outlook for 1927 in the heavy construction field is favorable. Since 1913, the annual rate of increase in the heavy construction volume has been more than 13 per cent.

PIT AND QUARRY FOREIGN DIGEST

System CaO — Fe_2O_3 — SiO_2

Three regions of this system have been studied and the compounds existing in a state of equilibrium have been determined. No optical evidence was obtained as to the existence of a ternary compound $CaO—Fe_2O_3—SiO_2$, in the regions studied. The existence of the substance $3CaO—SiO_2$ has been confirmed. It has been found that the transformation of $2CaO—SiO_2$ into the gamma form occurs in the chilled ternary mixture except when the concentration of $2CaO—SiO_2$ is low and that of the compound $CaO—Fe_2O_3$— is high. Attention is directed to the probability that only a part of the iron oxide in Portland cement clinker is in the crystalline form $2\ CaO—Fe_2O_3$ or $CaO—Fe_2O_3$. (Hausen and Bogue, Le Ciment, Vol. 31, p. 398-401, 1926).

Cement Industry of Chemical Products

In some cases the cement industry is accessory to a chemical industry. For example, the spent animal charcoal in the sugar refineries constitutes a source of lime for the manufacture of cement. The caustic soda industry too, has a similar residue and cement plants are erected in these two industries as adjuncts of the main product. Chemical products other than cement may also be corollaries of the latter industry. Potash is one of these by-products found volatilized from the cement mixture in the form of chloride and sulphate when certain clays are used. This, then constitutes a valuable by-product of the cement industry. (Dautrebande, Le Ciment, Vol. 31, 405-6, 1926).

Porous Concrete

The Copenhagen Polytechnic Academy has been experimenting on a new form of porous concrete. This material satisfied the requirements for ordinary construction, and can be cut, sawed, and planed. It is a good heat insulator. It is formed by mixing cement and gravel with alumbin and soap, the latter in the proportion of one part to 1,000 of cement. The foamy mixture is generally produced in a separate mixer by means of jets of compressed air. The concrete has a density from 0.1 to 1. At a density of 1 the compression strength is about 725 pounds per square inch. Then blocks are heated and dropped into water. They do not disintegrate. (Anon. Le Ciment, Vol. 31, p 414, 1926).

Concretes

Fibrous material such as peat, cork, wood pulp and particularly sawdust are saturated with water mixed with a small proportion of dehydrated lime, and exposed to the atmosphere to form a mineralized coating on the particles to render them suitable for use as an aggregate for concrete. The materials listed above may first be saturated with a weak solution of hydrochloric, formic or other acid to increase the hardness of the particles. (G. O. Case, British Patents 259, 635 and 259, 636).

Walls

Walls are formed by casting concrete between precast pillars each consisting of a single hollow asbestos cement or like unit extending from floor to floor. The pillars may be reinforced with hollow metal tubes. Grooves are arranged to key with the concrete. (A. Bates; British Patent, 259, 261).

Cement from Refuse

Town refuse is calcined in a preferably rotary kiln at a temperature not exceeding that of the resulting ash. The combustion may be supported by the use of additional fuel or of hot combustion gases. The ash is mixed with the necessary ingredients, such as lime to produce a cement-forming mixture, which is again calcined, preferably in a rotary kiln. (G. E. Hayl, British Patent, No. 259, 503).

Cement Guns

A cement gun or like device from which material is ejected by compressed air has the outlet end of the pipe connected to a casing of a larger section to reduce the speed of delivery. The casing is provided with a resilient diaphragm on the side opposite the point of entry of the material into the casing. (L. Krause, British Patent, No. 259, 510).

Fused Cement

The fused material from a rotary kiln is allowed to flow into a chamber where additional ingredients are intimately mixed therewith, and the mixture given further treatment where necessary. (G. Polysius, German Patent No. 434, 187).

Studies in Cement Burning

Commercial BaO heated with SiO_2 undergoes a vigorous exothermic reaction at 350 degrees with formation of barium silicate. SrO reacts similarly. CaO evolves whatever CO_2 it contains at 550 degrees and only above this temperature reacts with SiO_2. BaO containing H_2O reacts vigorously with alumina at about 350. Dry BaO formed from $BaCO_3$ by heat reacts at same point but less vigorously. SrO reacts vigorously at 450 degrees. CaO reacts with Al_2O_3 at about 600 degrees. A mixture of CaO—66 per cent, Al_2O_3—11 per cent and SiO_2—23 per cent heated to 1,000 to 1,100 degrees react and combine to form a compound or compounds with resulting hard cake formation. (B. Garre, Zement, Vol. 15, p. 844-847, 1926.)

American and German Portland Cements

Twelve American Portland and one White Cements were tested according to the German standards and the average figures compared with the ordinary and high quality German Portland cements. The setting periods of the ordinary German and American Portlands were the same, the High Quality German, having generally a shorter setting time. The specific gravities were all similar. The fineness of grain of American cements was found to lie between ordinary German and High Quality German cements. The average crushing strength of the American cements after 3 and 7 days was somewhat less, after 28 days higher than the ordinary German cements. The tensile strength of the American cements exceeded the ordinary German by an average of about 28 to 42 pounds per square inch. In composition the American cements were distinguished by a smaller lime content, and higher MgO and SiO_2 content. (G. Haegermann, Zement, Vol. 15, p. 861-864, 1926).

Effect of Use of Aggregate

Test slabs made of these pieces in a mixture of 1 part cement to 4.5 of aggregate and these were tested after 7 and 28 days and three months. The tensile strength as compared with the standard was more seriously affected than the crushing strength. (B. Garre, Zement, Vol. 15, p 870-871, 1926).

Prevention of Hardening of Slip

The slip is cooled as rapidly as possible from the grinding mill so that the absorption of water will be stopped and hardening prevented. This is done by having a cold water inlet in the discharge pipe from the mill which sweeps the warm slip into containers and floods it with cold water. (Allis-Chalmers Man. Co., German Patent Application, 45, 895).

Concrete Graves

The application of concrete building to graves is made by casting concrete walls, in the ground, slightly larger than the casket and decorated with appropriate painting devices, etc. Many advantages claimed for this type of grave. (J. Sucker, German Patent 967,065).

Effect of Sea Water on Concrete

The causes of the decomposition of concrete in sea water are both physical and chemical, the force of the tides and currents being very severe. The gravel used in such congrete should not be too fine as fine aggregate in this case tends to make a porous mortar. The mechanical destruction of concrete in sea water in most cases is retarded if not prevented by the fact that the masonry becomes covered with sea weed and barnacles. Chemical disintegration takes place by the formation of soft magnesium or aluminium gels, by diffusion or by shelling and cracking. Carbonic acid in the sea water tends to protect the surface by the formation of $CaCO_3$. Swelling is probably caused by the presence of unslaked lime in the concrete. Another cause of swelling is due to the formation of a calcium sulpho aluminate, 3 CaO, Al_2O_3, 3 $CaSO_4$, 30 H_2O, by the action of $CaSO_4$ in the sea water. On crystallization with this large amount of water, swelling and cracking occurs. Increasing the percentage of silica in the cement by the use of puzzolana or of gaize very much increases the resistance of the concrete to the chemical action of sea water, although its mechanical strength is somewhat lessened. (G. Baire, Chimie et Industrie also Le Ciment, Vol. 31, 408, 414, 1926).

Sulphur in Portland Cement

High percentages of $CaSO_4$ reduce the strength of cements, mortars and concretes. Concretes made with cements containing more than 6 per cent SO_3 crack in about a month. Those with 6½ per cent disintegrate badly, with less than 6 per cent cracking has not been observed for 11 months. It is stated that if concrete masonry does not crack in one month due to too great concentration of $CaSO_4$, the chances are that it will not crack at all. (F. Flajard, Le Ciment, Col. 31, p 416-417, 1926).

Credit to Concrete

Pit and Quarry desires to acknowledge that in the December 8th number of Pit and Quarry, in a contributed article entitled "Cement Plant Development," the illustrations were reproduced from Cement Mill Edition of *Concrete*, and also that much of the material was used, without permission.

Gypsum Producers Consolidate

It is reported that a consolidation of The Beaver Products Company, Inc., of Buffalo, New York, and the Southern Gypsum Company of North Holston, Virginia, was effected January 1, 1927. The Southern Gypsum Company properties include a very large supply of gypsum rock, mined at unusual depths, there being levels of one hundred, two hundred, three hundred and four hundred feet. The plaster mill at North Holston is one of up-to-date equipment of large capacity, and includes a mill for making gypsum block, or partition tile, and one for making gypsum lath, a backing for plaster.

The Southern Gypsum Company has been supplying plaster and other gypsum products to the entire Southeast for many years. Combined with the sales and service facilities of The Beaver Products Company, Inc., a still broader and more complete service to the trade will doubtless be effected.

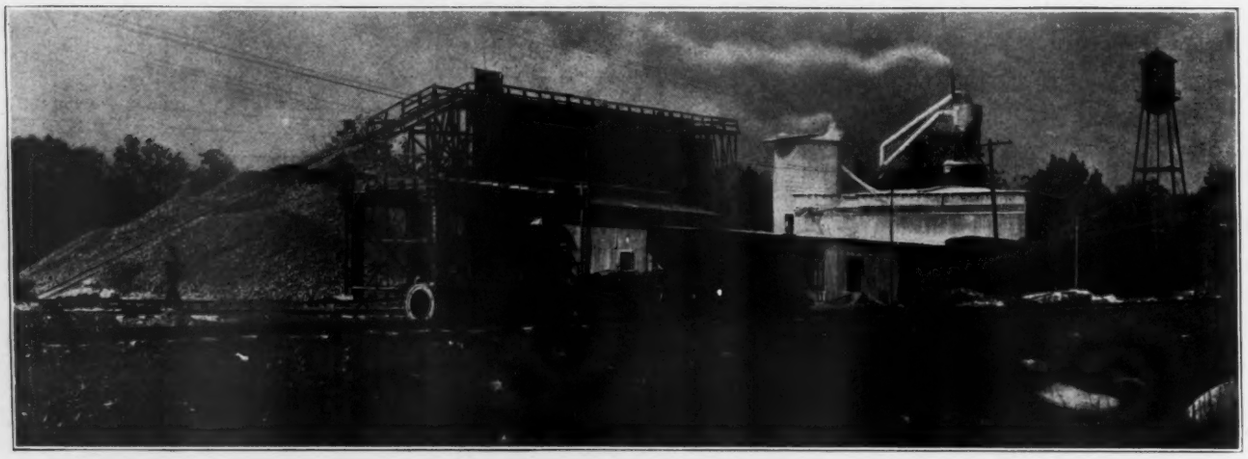
SUPERIOR LIME AND HYDRATE COMPANY KEEPS PACE WITH MARKET DEMAND

DURING the first three months of 1923, the Superior Hydrate and Supply Company of Pelham, Alabama, had a general survey made for a deposit for their proposed lime plant. A deposit of high calcium uniform quality rock was finally selected at Pelham, in Shelby County, Alabama. The stone analyzed better than 97 per cent CaO. On April 10, 1923, the company began the construction of a four Keystone kiln lime plant. On August 10, 1923, the first shipment of Superior White Lime was made from this plant.

View in Lime House

Drawing Kilns at Bottom

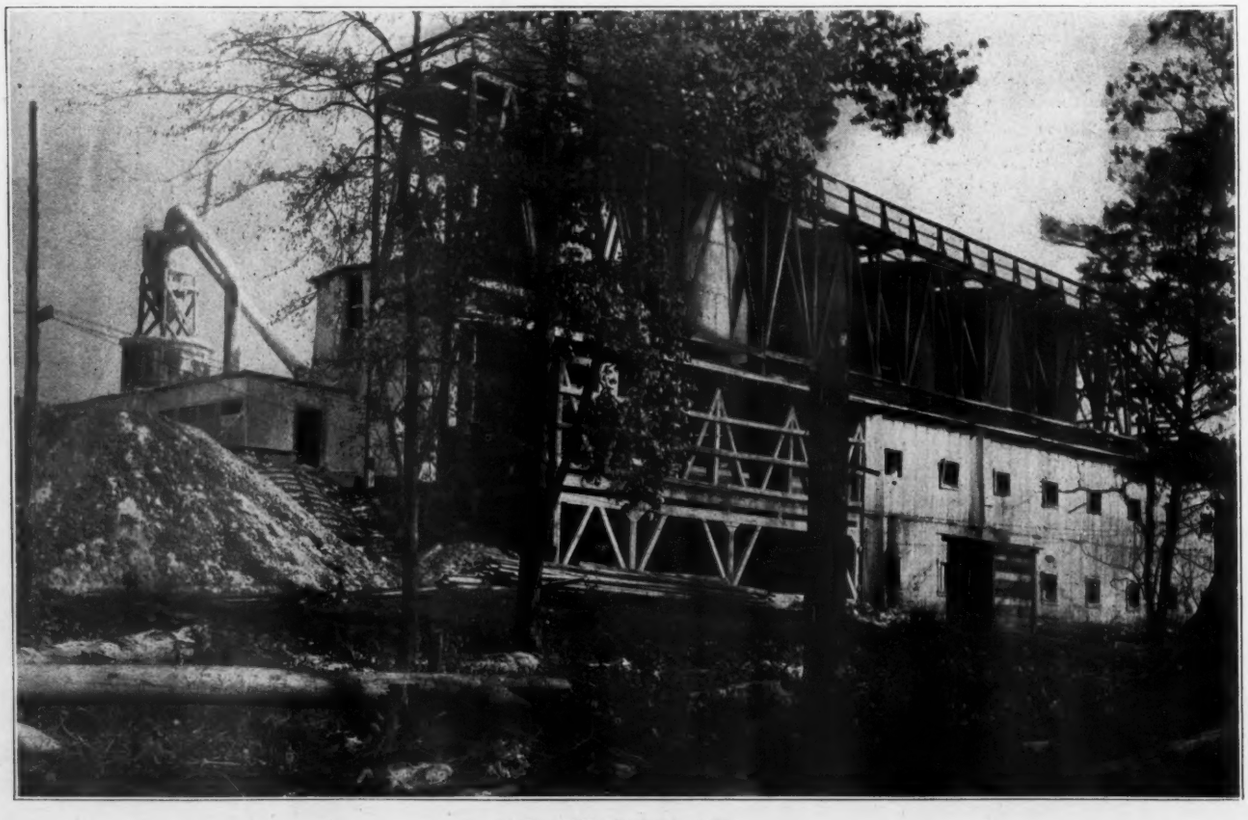
View at Rear of Quarry



View of Crusher Plant, in Foreground

The Hydrator

A substantial business was rapidly developed as a result of a policy calling for quality service and satisfaction. The demand for Superior White Lime increased and it became necessary in 1925 to expand the plant. In the later part of 1925 two more Keystone kilns were installed. These two additional kilns were in operation in February, 1926. Further expansion has become necessary and last November the Superior Lime and Hydrate Company decided to install another Keystone shaft kiln and a Clyde hydrator. These new units will increase the plant capacity to 1,000 barrels a day. A secret process is to be used in making a high calcium finishing lime. Tests demonstrate that this lime will have exceptional plasticity and a distinct white-



New Kiln Construction

ness. The white color is somewhat whiter than the usual finishing limes to be found in the Southern States.

The Superior Lime and Hydrate Company are also constructing a crushing plant for the production of agricultural limestone, paving dust, mine dust and other products for chemical purposes. The Birmingham industrial district offers an excellent ready market for these products.

The officers of the company are: H. G. Bridgewater, president; G. A. Paul, treasurer; R. L. Bridgewater, secretary, and G. M. Wood, sales manager.

Development of Electric Shot Firing

Gunpowder was probably known in the thirteenth century and used in firearms in the early part of the fourteenth century, state the Bureau of Mines, Department of Commerce, in a recently issued report. For more than 500 years after the development of gunpowder, the only means of igniting it was by sparks from flint and steel or by an open flame; therefore, quantities of powder could not be safely fired unless the explosive energy was directed as in a gun or cannon. Application of powder to industrial uses was consequently limited by the hazards which attended its use.

The introduction of electric shot-firing was a decided advance in the use of explosives, as it made their use safer and wider. Shots could be fired from distant points and through submerged circuits; also several shots could be fired simultaneously. Perhaps the earliest attempt to ignite powder electrically was made in America, when Benjamin Franklin, as early as 1751, had considerable success, using electrostatic sparks.

Other scientists, among whom were Priestly and Wolff, tried to ignite powder electrically, but the work remained experimental until the nineteenth century. One of the first practical applications of electric shot-firing was made in 1812 by a Russian nobleman, Baron Schilling, who during his work on military telegraphy in Russia, succeeded in insulating conductors and firing, by means of a Leyden jar, charges of gun powder across the Neva River at St. Petersburg, which suggested great possibilities of electric shot-firing in warfare. Later, Baron Schilling gave demonstrations of his achievement in France and in Germany. He fired powder charges not only at a considerable distance but across stretches of water. Further development was greatly handicapped by the lack of a more suitable source of electricity, as Leyden jars and electrostatic machines were the only sources then available. Therefore, the first marked advance in electric shot-firing came after the advent of the primary cell and the discovery that an electric current from these cells could be made to heat a short piece of resistance wire used as part of the circuit.

Powder was ignited by means of a primary cell as follows: The small piece of resistance wire in the circuit was embedded in the powder charge that was to be exploded. When the current was applied, the heat from the resistance wire ignited the powder. Electric shot-firing was further improved by the discovery in 1847 of a practical way to insulate electric conductors, so that powder charges could be ignited without leakage of current and shot-firing machines could be made that were not greatly affected by moisture. Later, about 1850, the development of the spark-gap and modern high-tension igniters made possible the ignition of explosives from great distances. The small firing current required by these igniters permitted the use of a firing circuit of higher voltage. However, general industrial use of electric shot-firing was restricted by the ever-increasing use of Bickford fuse, which had been invented in 1831 and which offered a satisfactory method of firing charges of black powder. An historical resume of the development of electric shot firing is contained in Bulletin 240, "Electric Shot-firing in Mine, Quarries, and Tunnels," published by the Bureau of Mines, Department of Commerce.

Water Cement Ratio Recognized By Department of Commerce

The building code committee of the U. S. Department of Commerce recognizes the "Water-Cement Ratio" as means of mixing concrete of a specified strength in a series of suggestions it makes in its booklet, "Recommended Requirements for Working Stresses in Building Materials." The "Water-Cement Ratio" is the law governing the strength of concrete. It states that the strength of concrete is in inverse proportion to the amount of water used in mixing provided that the mix is workable and that the materials used are clean and sound. Many engineers and builders had believed this was the factor governing the strength of cement and it was proved to be such by Duff A. Abrams, director of the Portland Cement Association Laboratory, who established the law after a long series of tests.

In the government booklet a series of tables are given in which the strength of concrete is shown to be directly dependent upon the quantity of mixing water used. Several aggregate proportions are given but in each case the resulting strength bears a definite relation to the volume of mixing water. A suggestion, similar to that issued by the Department of Commerce, has been made in a proposed building code prepared by the Pacific Coast Building Officials Conference.

Continued from page 70

wooden marker was placed at the head with the caption: "Here lies Carelessness, born—years ago, died—with our last lost time accident. Let's keep him dead." The safety engineer watched from his doorway to see the effect of this demonstration on the workmen and was surprised to see the large number of employees who stopped to read the inscription on the marker.

A large sign was painted in two colors and about the size of a city billboard was placed at the plant entrance facing the driveway leading into the plant. This was visible to workmen riding and walking to work for a distance of about a half mile. The wording on this billboard was changed on the first day of each month.

On the flag pole located on top of the screening plant, the highest point at that time, was placed a flag with this inscription, "No accidents yesterday." This flag was run up every morning at 7:00 underneath an American flag which floated every day above the plant. At night these flags were hauled down. If for any reason the flags were not run up at the scheduled time each morning, the safety engineer was liable to interruptions from men of all departments who stopped in to find out if there had been an accident the day before.

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Thursday, January 13, 1927
Engineers' Problems
Thursday Morning at 10:00
Grand Ball Room, Palmer House

Presiding—Mr. Thos. J. Wasser, Jersey City, N. J.

General Subject—Operation and Maintenance

Selection, Use, and Care of Equipment.
W. H. Root, Maintenance Engineer, Iowa State Highway Commission.

Maintenance Ills, Their Diagnosis and Cure.
William H. Connell, Acting Secretary of Highways and Engineering Executive, Pennsylvania Department of Highways.

Subgrade Effects Upon Highway Maintenance.
Prof. Frank H. Eno, Ohio State University, Columbus, Ohio.

Thursday, January 13, 1927
Final General Session
Thursday Afternoon at 2:00
Grand Ball Room, Palmer House

Presiding—Dr. Fons A. Hathaway, Chairman, Florida State Highway Department.

General Subject—Highway Problems

Best Method of Control and Payment for Pavement Quantities.
J. E. Ellison, First Assistant Commissioner and Chief Engineer, Minnesota State Highway Department.

Should Engineers' Estimates Be Made Public?
Arthur W. Brandt, Commissioner of Highways, State of New York.

Practical Qualifying of Bidders on Public Works.
*Frank T. Sheets, Chief Highway Engineer, Division of Highways, State of Illinois.

Increasing Efficiency in Highway Construction Organizations.
J. L. Harrison, Highway Engineer, U. S. Bureau of Public Roads.

Use of Powdered Lignite

Of late years much attention has been given by engineers to the use of powdered fuels, and it may be said that lignite can be successfully burned in this form, state O. P. Hood and W. W. Odell in Bulletin 255, recently issued by the Bureau of Mines, Department of Commerce. A number of factors, however, tend to limit such use. Lignite in the raw state contains so much moisture that it does not pulverize readily, tends to "ball up" in the pulverizer, and does not readily ignite. Although all of the moisture need not be removed from lignite in order to burn the latter in the pulverized form, the percentage of moisture should be reduced to a maximum of possibly 10 to 12 per cent. This means that for every ton of lignite dried (lignite containing 33 per cent of moisture) 518 pounds of water must be expelled, leaving 1,482 pounds of lignite containing 10 per cent of moisture, and this is equivalent to an evaporation of 699 pounds of water for the production of 2,000 pounds of lignite containing 10 per cent of moisture. To ship raw lignite to distant points, there to be dried in rotary driers for use as powdered fuel, is uneconomical.

Obviously the greatest economy would be to dry the lignite at the mine in order to utilize cheap fuel for drying and to reduce the freight and handling charges. Some lignites ignite spontaneously after drying unless carefully cooled, hence such a fuel cannot readily be dried and subsequently shipped in open containers unless specially handled. Lignites that tend to ignite spontaneously either could be pulverized at the mine and shipped in air-tight containers or rehandled before they could give trouble; or they could be partly carbonized at the mine and pulverized after shipping to distant points. The latter method is the most desirable for a number of reasons. A definite field of usefulness for lignite handled in this way is believed to exist.

Various systems are used to prepare and burn powdered fuel. In some places powdered fuel has been delivered in tight containers to small consumers, who are thus enabled to eliminate large storage capacity and the space and care required for the proper preparation of such a fuel. Although this method is not economical for large plants, it has proved an economy for hotels and relatively small boiler plants situated in the heart of a city.

Economist's View of 1927

Almost any review of opinions or expressions regarding future business will reveal the one outstanding characteristic: Confidence. Not only has the recent holiday trade, which paralleled if not exceeded all past records, provided the average industrialist and merchant with a stock of conservative optimism, but those whose business and prestige depends upon their ability to predetermine commercial trends are almost unanimous in the belief that throughout at least the first half of 1927 general trade can be nothing short of good.

With one or two exceptions, notably lumber and agriculture, the sentiment of the business world seems well contained in the statement of C. H. Markham, chairman of the Illinois Central Railroad, which was: "The momentum attained by business in general during 1926 will serve to keep the channels of trade in a reasonable degree of activity during 1927, irrespective of minor disturbances which may possibly develop."

As a consensus of opinion from the leading economists we present the following:

Babson: General business should continue at about the present levels. There are no indications of any material price fluctuations for the immediate future, and production should continue at relatively high levels.

Alexander Hamilton: There are sufficient favorable factors to prevent any trade reaction from becoming a general business depression. There has apparently been some over-production, but not of serious proportions.

Bankers Economic: While there are no indications of general business exceeding its present levels, it is significant that money has become easier. Europe appears to be making persistent headway in straightening out her finances.

Gibson: General business promises to continue in good volume with extremes neither one way nor the other. The long term outlook is for lower commodity prices, although general demand should keep production volume at a high level.

Brookmire: Business may show a slight decline during the first quarter of 1927. Credit extensions should be carefully scrutinized in anticipation of possible declining business profits. The present tendency is toward lower volume and better quality.

Harvard Economic: The present level of general business, we believe, should continue during the first quarter of 1927, although some curtailment of production may reasonably be expected to follow:

United Business Service: Moderate contraction in general business is indicated for the next few months, although severe deflation seems unnecessary. Volume of trade continues from 3 to 5 per cent above a year ago, despite spotty conditions.

Moody: General business is continuing in large volume, but not of boom proportions. There seems little chance of any immediate downward revision of tariff to disturb business.

Poor's: We see no reason why the volume of general business should not continue satisfactory. The political outlook is for a congress that will probably accomplish very little.

Destructive Distillation of Oil Shale

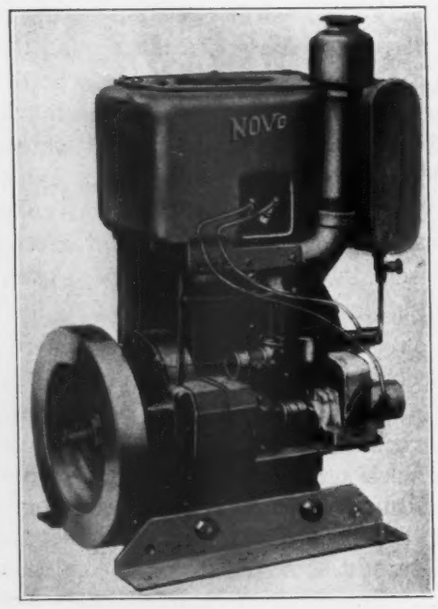
Knowledge of the chemistry of pyrolysis (the down by heat) and pyrogenesis (the formation by heat) of organic substances is being rapidly extended through the growing use of these principles in the cracking of oils and in the industries of coal distillation and gas manufacture, states the Bureau of Mines in a recently issued manual of testing methods for oil shale and shale oil. The thermochemical reactions in the destructive distillation (retorting) of oil shales are similar to those that occur in cracking oil and in carbonizing coal. The retorting of oil shale is similar to the low-temperature distillation of coal in that the products are a carbon residue containing a relatively high percentage of volatile matter, a small yield of gas, and a large yield of oil. High-temperature distillation of oil shale or coal gives a carbon residue having a low proportion of volatile matter, a large quantity of fixed gas, and a small quantity of oil. The oil produced by low-temperature distillation is much more easily refined to yield petroleum substitutes. The fixed carbon that remains in the spent shale corresponds to petroleum still-coke or to the coke from the carbonization of coal; the amount of volatile matter present in the coke is reduced as the temperature of distillation is raised.

The first action of heat on oil shale is the removal of the occluded gases that are present in small quantities. Also, in some shales low temperatures remove traces of light oil that may have been present as such or perhaps, prior to its decomposition, as resin or bitumen. As the temperature is raised, the organic matter of the shale decomposes and produces vapors which condense to form shale oil. Simultaneously, fixed gases are evolved. When the organic matter of the typical shale is heated, it changes first into a soluble bitumen and, as the heating continues, this bituminous substance further breaks down or "cracks" and forms shale oil. Whether all shales yield a bituminous substance of this kind as a primary decomposition product is not definitely known as yet. Some of the rich shales yield less bitumen than leaner shales when both are subjected to the same temperature and period of heating. A possible explanation of this paradox is that these richer shales produce a larger amount of bitumen that is less stable and therefore breaks down quickly into vapors and gases.

New Novo Line

The Novo Engine Company are introducing a new line of engines known as type "U." There are three sizes of these engines, U F, 6 horsepower, R U, 9 horsepower and Y U, 12 horsepower. All of these engines are two cylinder, 180 degrees opposed throw counterbalanced crankshaft, and built either hopper or radiator cooled.

The features of the new Novo U engines are as follows: By the use of the 180 degree opposed throw counterbalanced crankshaft, a smooth flow of power without vibration is obtained; both crankshaft and drive shaft are fitted with Timken tapered roller main bearings; independent power take-off shafts having four speeds and right and left hand direction of rotation; drive furnished on either side, magneto and carburetor always away from the machine being operated; automatic impulse starter on magneto; provision of hand hole plates, so that engines need not be removed to adjust or inspect connecting rod or oil pump. The oil pump is positive driven; and engines always crank right hand.



Novo U, Hopper Cooled Type without House

This company has also added the new Novo N H light duty hoist, which is made with a welded steel frame. This new hoist is powered with Novo one or two cylinder gasoline engines, or electric motors. The hoist is a single drum unit, incorporating such features as double cone frictions and a screw thrust mechanism. This new hoist has a complete welded frame, the engine or motor bed plate being welded to the channels. A tubular cross member welded to the channels prevents warping or distortion. The Novo D H 325 heavy duty double drum hoist has also been improved. A counter or idler shaft and pinion, placed between the two drum gears, makes both drums rotate in the same direction. This permits the spooling of the cable on the top of the drum and enables the operator to locate cable marks easily. These hoists, single and double types, are powered with Novo four cylinder engines or electric motors, 20 to 50 horsepower.

Novo Company also offers new enclosed, self-oiling, one, two and three cylinder piston pumps. The Novo pump, either one, two or three cylinder, is double acting, inside packed, powered with Novo one and two cylinder gasoline engines or electric motors. All working parts, gears, pinions, cross head and bearings, are automatically lubricated and run in a bath of oil. The triplex pump has a capacity up to 70 gallons per minute at 500 pounds pressure, is powered with a Novo N F 25 horsepower, four cylinder engine and is mounted on a steel truck.

Hayward Drag Line Buckets

The Hayward Company has recently published pamphlet No. 666-A describing the Hayward drag-line buckets. This new type of bucket is designed to stand up under the hardest kind of bucket usage. In order to prevent pulling together of the open front, heavy top plates are used on the back of the bowl with cast steel pulling lugs running from the back of the bowl to the front, at which point the pulling bridle is attached. All castings are made of open hearth steel. Manganese steel is used for the teeth, cutting edges and adjustable shackles. The bowl is made of reinforced heavy flange steel plate and has additional stiffener runners to prevent wear on the bowl plates.

In addition, the bowl is reinforced further by a manganese cutting edge running from the top of the bowl on one side, extending across the bottom, and to the top of the bowl on the other side. The bridles are made of hand forged steel dredge chains. All sheaves are of cast steel, bronze bushed and fitted with a specially designed swivel adjustment.

Some of the features of this bucket are: Its ability to drag as soon as the drag line is pulled tight, in any material that a drag line bucket can handle; it can be operated on any type of machine designed for bucket work and on a boom of any length; It carries a full load to the end of the boom; It is speedy in operation, due to short bridles which allow quick dumping; It has an open front with no projection except the teeth, which, together with the cutting edge, are presented at a predetermined angle to the material, irrespective of the angle of the slope in the bank; It has low headroom and consequently can be operated on a machine using a comparatively short boom; and it is built in the interchangeable part system, assuring duplicate parts which are shipped from stock.

Using Compressed Air in Cement Storage

A somewhat novel use for compressed air is described by Mr. M. A. Eiben, president of the Northern Blower Company. Although it was originally invented for use in connection with Norblo dust-handling and recovery installations in cement mills, it would seem to be equally applicable to other industries which necessitate the storage of large quantities of bulk material in a finely divided state.

When first stored, cement is of course light and fluffy, but as the air is gradually squeezed out of the mass by the weight of the upper layers, it tends to settle down into a tightly-packed condition. Since the discharge gate is at the bottom of the bin, a bridge of packed cement forms above it, and thus tends to prevent the free flow at the chute.

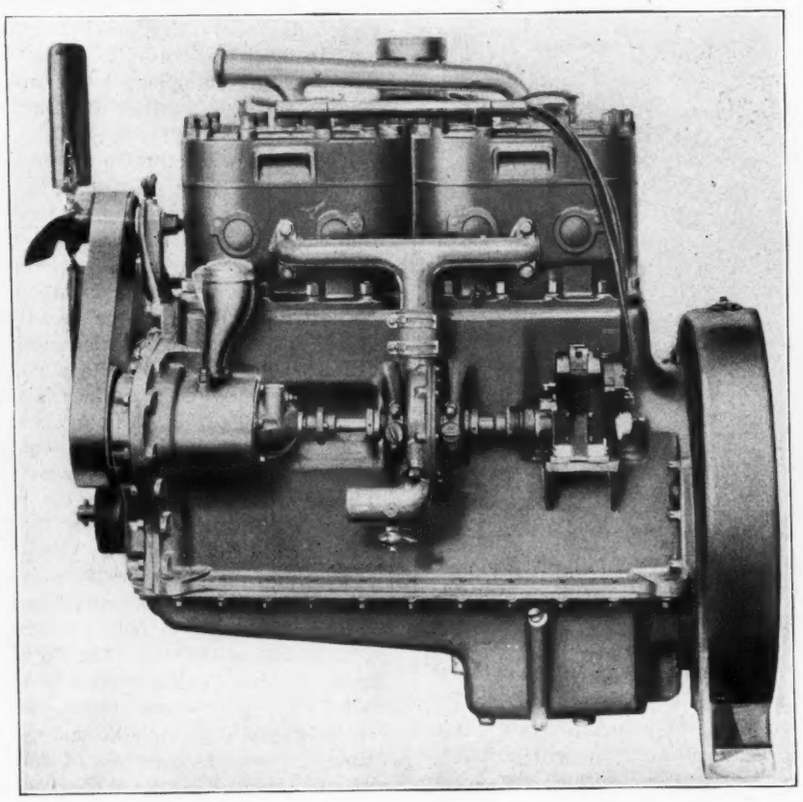
To avoid the delay involved by loosening up the material by the usual method of thrusting long rods up the discharge chutes, a compressed air pipe is let into the bottom of the bin. The discharge gate being first tightly closed, the air, at approximately 100 pounds pressure per square inch, is forced into the packed mass. The air steadily spreads outwards and upwards, thus surrounding each grain of cement. In a few moments the upper surface commences to heave and the cement is once more light and fluffy as before. The cost of thus freeing the discharge gate is stated to be only a fraction of that of the former method.

Osgood Company to Exhibit at Good Roads Show

The Osgood Company will exhibit in their space, Booth 29, at the Chicago Good Roads Show to be held in the Coliseum the second week in January, an Osgood 1¼ yard heavy duty gas crane. This machine is the latest addition to the line of machinery built by this company and includes many advance-features in design which add to its simplicity of operation and maintenance. The machine will be equipped with a structural boom of the lattice bow type. The new all enclosed gear drive truck developed by the company during the past year will be shown for the first time under this machine.

New Waukesha Motor

The Waukesha Motor Company announce a new size of their super duty service four cylinder engines. These will be known as the "J" type. They are available in two sizes, the "JS" having a bore of 5¼ inches and "JL", a 6 inch bore. These engines form an intermediate step between the "DU" and "GU" engine and the "WS" and "WL", and develop 60 and 70 horsepower at a normal governed engine speed. The use of a 3¾ inch diameter crankshaft, "girder type" crankcase, "truncated type" cylinders, and the famous "Ricardo Head" combustion chambers distinguish them for long life and economical operation in the field in which they are used. They are suitable for all industrial power purposes, either as individual engines for crane and locomotive work or as unit power plants to drive rock crushers and screening plants.



New Waukesha Motor

Miami Industrial Trailer

The Miami Trailer-Scraper Company has recently issued a bulletin describing the Miami Industrial trailer. This vehicle is all steel, of the 4-wheel type and designed from the viewpoint of a low cost, slow speed trailer for tractor operation. It has a carrying capacity of 2½ tons with ample factors of safety. It is built for a short turning radius of the cut-under type so that the trailer may be turned in its own length.

The front gear construction provides fully for the tilting of the front wheel sideways in mounting obstructions to either front wheel. The rear wheels are 40 inches in diameter with a 7 inch face tire, the front wheels are 26 inches in diameter with 5 inch face tire. The chassis frame is made from 6 inch rolled steel channel, weighing 10½ pounds to the foot, and provided with suitable risers and braces to keep the rear axle rigid under the load.

Each wheel is fitted with two Timken tapered roller bearings to receive the end thrust of the load. The wheel hubs are accurately machined for the Timken bearings, a felt washer being mounted in a groove on the inside shoulder of each spindle and a hub cap fitted to the outside hub flange insuring fully a dirt proof hub. Lubrication of the wheels is accomplished through Alemite nipples making it unnecessary to remove the wheels except for the occasional cleansing of the Timken bearings. The drawbar is constructed for attachment at any height, that these trailers may be coupled in trains of two or more by mounting a towing hitch connector to the rear cross member of each trailer.

The circular also shows a number of applications of the trailer chasses such as, pole-lumber and pipe trailers, camping or utility trailers and bottom dump cars. The dump cars are made in two models: MD 4, 56 inches from ground to top of body and 1½ yards water level capacity and MD 5, 61 inches from ground to top of body with ½ yard top box having a total capacity of 2 yards water level. The body construction of these dump cars is interesting, the dumping doors being hinged directly to the chassis frame or side channels. This construction provides the low loading heights from the ground to the top of the body. The flared body is constructed of number 10 gauge steel and mounted on top of the channel frame by means of bolts.

The dumping and winding up of the bottom dump doors is through two levers. The dumping lever may be operated from the tractor driver's seat by means of a rope. The closing of the dumping doors is done by a winding lever placed on the right side of the trailer. The bottom dump doors, the regular body, as well as the dumping and winding levers, winding drums and shaft are all mounted to the frame with bolts so that these parts may be removed if required, substituting a stake platform body measuring 5 feet 6 inches by 10 feet.

Wet and Dry Process Aids Dust Elimination

A novel combination of the wet and dry process dust collecting system has recently been installed by the Northern Blower Company which is stated to overcome the difficulties generally met with in the recovery of hot gases and dust from dryers, kilns, etc., and in the operation of coal-crushers.

Hitherto neither the regular dry nor the wet process has been entirely satisfactory for such work. With the former, it was not practical to prevent the escape of a noticeable quantity of the dust because it was necessary to use a cyclone collector which is not as efficient as an arrester in which the dusty air may be filtered through fabric. In the wet process on the other hand, the action of the moisture in the spray chamber converted all the recovered material into sludge which was somewhat difficult to deal with afterwards.

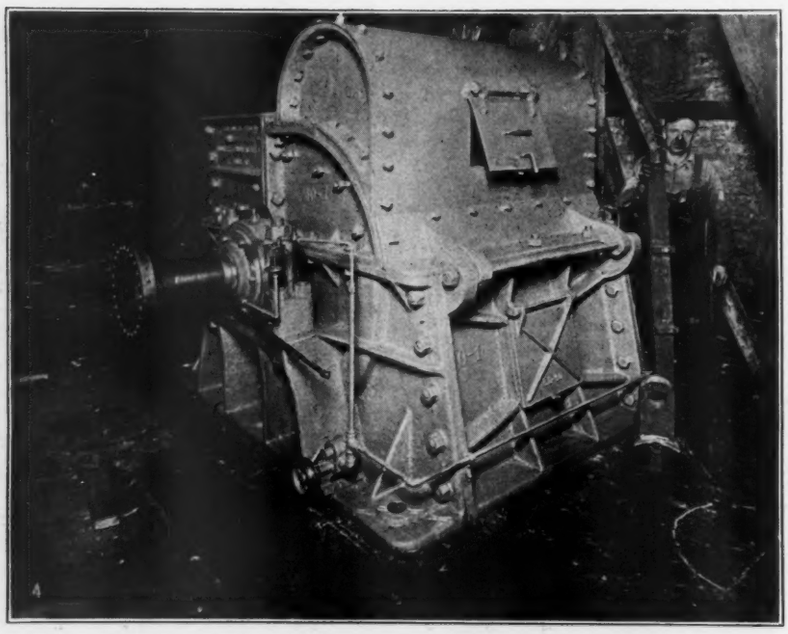
The present installation, however, uses both a dry process cyclone collector and a wet process spray chamber. The greater part of the dust is therefore recovered in a dry form, ready for immediate utilization, and the comparatively small remainder is converted into sludge. The elimination of dust-nuisance is thus accomplished with a minimum of loss.

This method has also considerable advantages when applied to coal crushers and dryers, for it effectively prevents the risk of explosion generally present where fine coal dust is handled, and at the same time permits the coarser grains to be fed to the furnaces without preliminary drying.

Gruendler to Expand

The Gruendler Patent Crusher and Pulverizer Company have been manufacturing crushing and pulverizing machinery for forty-one years. This company expects to be in a new factory within the next six months. One of the latest of the Gruendler large hammer mills has been shipped to the Dewey Portland Cement Company for their new plant at Davenport, Iowa.

This company manufacture all steel cast jaw crushers, swing hammer crushers and pulverizers with tramp iron catchers, pulverizers with air separation, rolls, revolving stone screens, elevators, cyclone metal dust collecting systems, steam and electric car pullers, derricks, crabs and transmission machinery.



Gruendler 50x52 inch Cement Crusher

The Gruendler heavy duty all steel hammer mills with reductions of 48 to 1, 36 to 1, 24 to 1, and 12 to 1 are of the modern type and are equipped with heavy duty roller bearings, continuous oil feed and tramp iron catcher. The Gruendler all steel preliminary jaw crusher is manufactured in various sizes both stationary and portable. The Gruendler centrifugal roll pulverizers with air separation give a fine reduction from 100 to 300 mesh.

Novo Exhibit at Road Show

The Novo Engine Company will occupy space 67 at the Chicago Road Show and have the following equipment on exhibition. Heavy duty, improved D H, 325 double drum hoist with countershaft, powered with a Novo E F, 40 horsepower four cylinder engine. New N H single drum hoist with welded steel frame, powered with a new U F, 6 horsepower two cylinder Timken tapered roller bearing engine.

New "Flud-oil-d" enclosed, self oiling, horizontal triplex high pressure single acting piston pump, mounted on welded steel track, powered with a Novo NF, 25 horsepower four cylinder engine. New "Flud-oil-d" enclosed, self oiling, horizontal duplex, double acting piston pump, mounted on welded steel truck, powered with a Novo A F 18 horsepower four cylinder engine. New, "Flud-oil-d" enclosed, self oiling single cylinder, double acting piston pump, mounted on welded steel frame, powered with a Novo U F 6 horsepower two cylinder Timken tapered roller bearing engine. New, "Flud-oil-d" enclosed, self oiling, single cylinder, double acting piston pump, mounted on welded steel frame, powered with a Novo 4 horsepower single cylinder engine.

Four diaphragm pumps, two single open top four inch, one with 3 horsepower, electric motor and the other powered with a Novo 3 horsepower single cylinder engine; one single closed top force diaphragm with a UF 6 horsepower two cylinder engine; one double open top diaphragm pump with a U F 6 horsepower two cylinder engine. All diaphragm pumps will be shown mounted on welded steel trucks.

One U E 3 direct connected centrifugal pump mounted on welded steel truck, powered with a U F 6 horsepower two cylinder engine.

The following engines will also be on exhibition, U F, 6 horsepower two cylinder, radiator cooled type, with air cleaner; U F, 6 horsepower two cylinder, hopper cooled type, less house, equipped with clutch and air cleaner; R U, 9 horsepower, two cylinder, hopper cooled type, less house, equipped with clutch and air cleaner; Y U, 12 horsepower, two cylinder, radiator cooled type, with air cleaner; N F, 25 horsepower four cylinder, mounted on steel truck, equipped with 10x18 inch friction clutch pulley and outboard bearing and a 3 horsepower single cylinder unit.

Extension Side Dump Car

The Clark Car Company has issued leaflet number 30 describing the extension side dump car. These balanced door dump cars are built on the principle of so balancing the load and moving parts of the car that minimum effort is required to dump and close them after dumping. It is claimed that further benefits arise out of the balanced condition of the car than merely the economy in power to operate. Some of these are better live load to dead load ratio, less destructive shock in dumping, lower maintenance cost and absolute stability on the track.

These cars will dump to either side and may be dumped singly or in trains. Each car is equipped with a dump valve so arranged that the dumping of two or more cars simultaneously is controlled from any car in the train. The dumping operation may be controlled from the locomotive, if desired, and in such cases a dump valve is installed in the engineer's cab. In sizes of 20 to 30 yards, a manual reversal dump simplifies the equipment. Air reversal is, however, optional on these sizes and is the only equipment furnished for the 35 to 50 cubic yard capacity.

The dumping operation is accomplished by the admission of compressed air to dump cylinders mounted on each end of the car. The flow of air to and from the cylinders is controlled by the dump valve, conveniently located in the stationary end frame. A storage reservoir of ample capacity, located between the center sill channels, supplies air for dumping purposes. This reservoir is charged under usual conditions of operation by the locomotive compressor. Balanced doors are applied to a variety of hopper car designs and are furnished in response to inquiries.

The extension side dump cars are carried in stock with a capacity of 30 cubic yards level full, 100,000 pounds, but the company are prepared to furnish any size of equipment from 20 to 50 yards capacity in response to inquiries, any size being equipped with suitable weight capacity rangeing from 80,000 pounds to 100,000 pounds.

Elmes Hydraulic Line

The Charles F. Elmes Engineering Works manufactures a complete line of hydraulic machinery which comprise jacks, pumps, forcing, straightening and bending presses, testing machines, accumulators, valves and fittings. Some of these machines are applicable to the Pit and Quarry field, namely forcing, wheel and tires applying presses. The forcing presses are made in two types, stationary and portable and with a wide range of capacities.

One variation of the portable type is made with a separate hydraulic jack and pump and can be used to advantage for such purposes as pressing on and off cranks, armatures, wheels, couplings, and the like. Owing to the fact that these units are made with the pump separate from the jack, the pump can be placed in any convenient position or distance from the jack, thus eliminating all chances of injury to the operator. To maintain equilibrium when lifting heavy, bulky material, two jacks may be simultaneously operated from one pump.

The wheel presses are made in both horizontal and vertical types. The stationary horizontal presses are made with a range of capacities from 100 to 400 tons, with openings between bars from 48 inches to 96 inches. They are built to withstand the usual rough usage of repair shops. While they are especially adapted for pressing on and off car wheels, locomotive drives, etc., they are equally as handy for pressing off a variety of work, such as armatures, pulleys, couplings, etc.

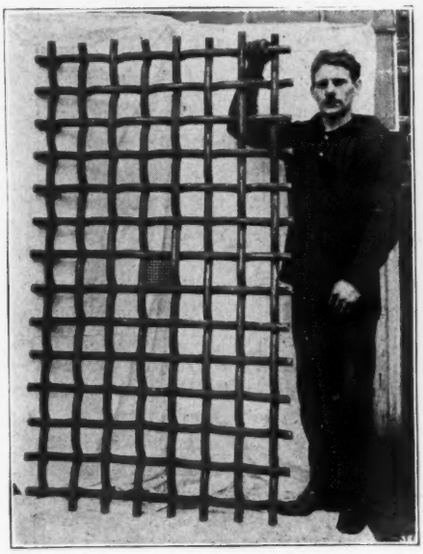
The vertical types are also built in various sizes and combinations to suit requirements. They are conveniently arranged for any forcing work limited to the distance between the columns. The tire applying presses are made in several designs and in a wide range of sizes. Some of these are manufactured with the main stress members of annealed steel casting while on others the frames are of heavy rolled steel sections, with corner connections hot riveted through reamed holes.

The cylinder is a special grade of steel casting with a generous throat guide which insures long life to the ram and minimum packing trouble. The ram is close grained iron with the working surface polished and ground. The bottom platen is concentrically grooved to facilitate the placing of wheel in the proper position. The pump is a duplex outfit working through eccentrics which are integral with the driving shaft. Ample oiling and lubricating devices are provided for all rotating surfaces and the presses are built to insure maximum service and minimum repairs.

Heavy Rol-man Screen

The illustration shows what is claimed to be the heaviest rolled manganese steel rod screen ever woven and made by the Manganese Steel Forge Company. The openings are 3¾ inches square and are made of 1¼ inch diameter rolled manganese steel rods. All crossings on each of the four sides are welded with manganese steel, thus making the screen exceptionally rigid and effectually preventing possible ravelling or looseness of the rods on the edges. The screen weighs 403 pounds. For a comparison of size, a section of ¼ inch opening 3/16 inch rod screen has been placed in the center opening.

This company also supply Rol-man screens woven of 1 inch diameter and ¾ inch diameter rods as well as in all sizes from ⅝ inch diameter down to 3/16 diameter rods.



Heavy Rol-man Screen

Diamond Power Specialty to Exhibit

An attractive feature of the Diamond Power Specialty Corporation Exhibit at the Chicago Power Show will be a miniature boiler. By means of this boiler the principles of the correct application of soot blowers to varying boiler conditions will be demonstrated. The effects of soot deposits in retarding heat transmission, and the benefits of soot removel, will also be shown.

In addition to this working model, motion picture films showing the use and benefits of soot blowers on oil fired boilers, will be shown. These films, which were made by the United States Navy, are part of its training course in boiler room practice. Representatives of the Diamond organization will be present at the show to explain its exhibit to those interested.

Brown Bevis Change

An announcement of interest to contractors, purchasers, equipment distributors and manufacturers is contained in the report of the retirement of Mr. Daley G. Bevis, vice-president from the firm of The Brown-Bevis Company, Inc., as the stock holdings of the retiring member have been purchased by Dan. R. Brown and associates.

No change of policy or conduct of the business is contemplated and the firm name will be continued for an extended period of years with no change in the accounts represented; except in the addition of a Railway Supply department and the addition of one or two accounts covering heavy equipment.

Dan R. Brown

The firm of The Brown-Bevis Company, Inc. was organized in 1919 and distributes equipment in the Pacific-Southwest district, with an annual volume of sales exceeding on an average a million dollars per annum.

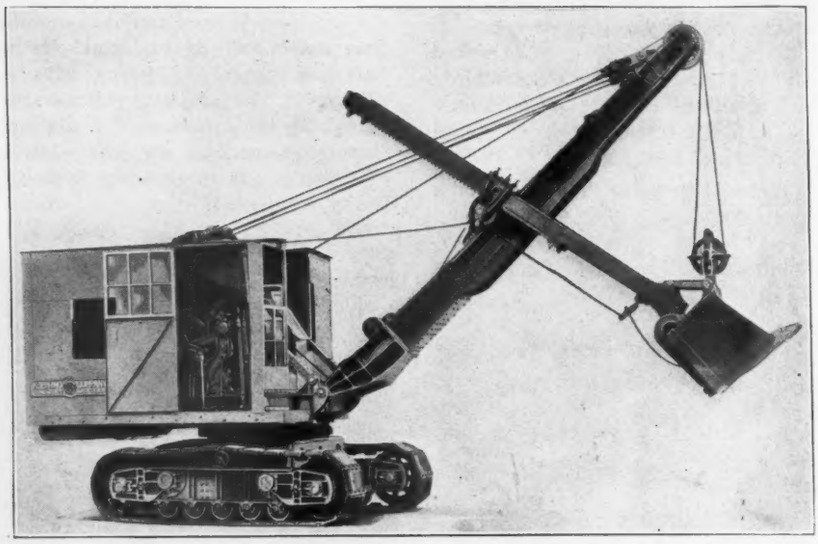
The officials and personnel of the Company commencing on the first of January nineteen twenty-seven are: Dan R. Brown, president; Chas. W. Miller, vice-president; Geo. R. Bury, treasurer; Walter M. Parsons, assistant to president and sales manager; Rex Hardy, secretary. The staff of twelve engineering salesmen complete the sales force, and plans for nineteen twenty-seven contemplate a thirty-five per cent increase in sales over the past year.

Northern Blower Appoints

The Northern Blower Company, manufacturers of equipment for dust handling and removery, fume removal and shavings disposal, announces the appointment of Mr. Herbert Roush-Kolb as its new representative in Detroit, Michigan.

Koehring to Exhibit Shovel

The Koehring Company will exhibit its 27E paver and number 1 gasoline shovel in space number 43 on the main aisle of the Coliseum at the Road Show in Chicago, January 10-14. The several features and improvements which are responsible for the remarkable operating adaptability of the 27E paver will be shown in complete detail.



Koehring Number 1 Shovel

One of the most important improvements in the paver design is the grouping together of the high speed operating gears in a completely enclosed operating gear case. This permits the gears to run in a bath of oil free from dirt and foreign matter.

The water supply system is exceptionally fast and accurate. A straight flow tank to drum through a 3½ inch pipe secures a clean discharge in the least possible interval of time. The minute adjustment which will measure the exact quantity desired is regulated by a convenient hand wheel.

Both the height and width may be changed by easy adjustments in the field. The standard width of the multiplanes which is 90 inches may be readily reduced to 82 inches. The easy steering mechanism, the self-cleaning multiplanes and many other heavy duty features will prove interesting to the paving contractor.

The Koehring heavy duty gasoline shovel, with its many profit making features, which will be shown will be the number 1 with a ¾ yard dipper. This shovel is equipped with a powerful cable crowd which is independent of every other function. Another important feature on this machine is a power dipper trip which was recently made optional equipment on these shovels. The trip conforms to the Koehring principle of "Finger-tip" control inasmuch as the operator merely gives a slight touch to a conveniently located lever to trip the dipper door. A twofold advantage is gained from this improvement. An extra man is eliminated from the cab and the operating speed is increased.

At the lower end of the boom is a powerful shock-absorbing spring which relieves the severe stresses on the boom, dipper sticks and parts throughout the machine by cushioning incidental or accidental shocks. Positive steering controlled from operator's position in the cab, outside band friction clutches, control of the boom angle from the cab and easy accessibility of parts are other advantages on the shovel. Other products manufactured by the Koehring Company includes: concrete mixers, gasoline cranes and draglines, subgrade planers, bar bonders and bar cutters.

New Symons Cone Crusher

The Symons Brothers Company has recently designed and introduced to the field the new Symons Cone Crusher. The object in building this crusher is to combine, in one machine, the advantages of both the Symons horizontal and vertical disc crushers. It is claimed that the large ratio of reduction of the horizontal, the fine uniform product of the vertical and the capacity of both are accomplished by the use of this cone crusher.

The gyration of the crushing head in the cone crusher is similar to that of the ordinary gyratory, with the exception that it moves at least five times as great a distance and gyrates faster. The action of the stone is entirely different. The rapid gyration and long movement drops the head from under the stone after each crushing impact and allows the stone to fall vertically away from the outer bowl. The number of gyrations of the head per minute regulates the distance the stone will travel between crushing impacts. The result is high pressure per square inch on the stone and low pressure per square inch on the bearings.

Since the stone falls a certain distance between crushing impacts, the angle between the head and the outer bowl regulates the amount of reduction at each stroke. The lower part of the head and the lower part of the outer bowl are parallel for a sufficient distance to insure the head making one complete gyration before the material will drop the entire width of the zone. This means that the closed side of the crusher regulates the maximum size of the product.

The crusher consists of a conical head gyrated, not rotated, by an eccentric that is driven through gears and a countershaft. The head is supported by a large socket bearing with no bearings or spider above the crushing cavity to obstruct the flow of material. Opposing the head is a crushing bowl threaded on its outer circumference for the purpose of raising or lowering it. The bowl is held in place by an adjustment ring, threaded inside to fit the bowl threads, and held down on the main frame by a circle of long springs. These springs are flexible enough to allow the bowl to raise the full movement of the head when tramp iron or other non-crushable material enters the crushing cavity. The maximum pressure that can be produced by these springs is a known factor, and as this governs the strains in all parts of the crusher, it is possible to build every part with sufficient strength to avoid breakage. A feed distributing and regulating plate is mounted on top of the main shaft with a vertically adjustable feed spout above it. A large oil tank and pump form a part of the standard equipment. The pump may be motor driven or flexibly connected to the countershaft of the crusher.

To change the size of product or take up wear, six screws are loosened to allow clearance in the bowl threads. The bowl is screwed up or down with the aid of two ratchet lever windlasses. When the desired setting is obtained, the bowl is locked in place by dropping a pin or bolt through a lock link. The six screws are then tightened to prevent play in the bowl threads.

These crushers are manufactured in five sizes, 2, 3, 4, 5½ and 7 foot cone and require 25 to 30, 50 to 60, 75 to 100, 125 to 150, and 150 to 200 horsepower, respectively to operate them.

G. E. Air Compressors

The General Electric Company has recently issued bulletin G E A-528 describing the small, multi-stage centrifugal air compressors. This company has been manufacturing for the past ten years these units rated at 250 to 575 cubic feet per minute and 0.75 to 410 pound pressure. These smaller units are part of a complete line of centrifugal air compressors or blowers, ranging in volume from 250 to 75,000 cubic feet per minute and 0.75 to 30 pound pressure.

In line with recent improvements made on the large multi-stage and single-stage units, changes have been made in the design of the minature multi-stage sets. Among the many advantages special attention is called to the gear type oil pump geared to the motor shaft and providing forced feed for the three bearings.

These small units are made with the casing of cast iron and split vertically so that any number of stages from two to eight can be assembled to give the various pressures. The impellers are made of aluminum and are of the single inlet type. Discharge vanes receive the air from the impellers and, in addition to conveying the air to the next stage opening also serve to convert a large part of the velocity energy into pressure energy, thus increasing the efficiency of the compressor. All units can be furnished with 230 volt, direct current and 2 or 3 phase, 60 cycle, 220, 440 or 550 volt motors.

Climax Exhibit at Road Show

The Climax Engineering Company, are showing a complete line of Climax "trustworthy" engines at the Road Show. Each of their well-known models will be on exhibition. The Booths, W-11 and 12, will be in charge of Lorimer Dunlevy, sales manager, and he will be assisted by M. E. Collins, service manager, and sales representatives, R. B. Sinnock, T. L. Keeling, and F. E. Glanchard.

Among the engines on view will be the Model "TU". which has been used in so many well-known makes of cranes, shovels, ditchers, and similar types of road building machinery. This is a four cylinder, 5½ inch by 7 inch engine with necessary manifolds, built-in governor, Bosch magneto, Stromberg carburetor, spark plugs, flywheel, cooling fan and others accessories. This engine develops 77 h. p. at 1200 r. p. m. which is its maximum speed. The Model "KU", four cylinder, 5 inch by 6½ inch engine will also be exhibited. This is a smaller engine than the Model "T," but it has earned its place in the industrial world through years of service.

Both the Model "A4U" and "R6U" engines are at the Road Show this year. These models are made in four and six cylinders, having a six inch bore and seven inch stroke. The engines have been skillfully designed and give a full measure of power. Both the engines are shown complete with carburetor, ignition, flywheel, cooling fan, governor, and other equipment. Following their plan of last year, the Climax Engineering Company will present visitors at their booth with red carnations.

G. E. Turbines

The General Electric Company has recently published bulletin GEA-578 describing the mechanical drive turbines, type D. These steam turbines are designed for operating centrifugal pumps and other apparatus. The impulse type of turbine is pressure compounded when arranged with more than one stage, and velocity compounded in each stage by using two rows of revolving buckets. The steam passes only once through each row of buckets and, since there is no drop in pressure within each stage, it is practicable to use large clearances between the bucket wheels and the stationary parts without steam leaking out through the clearances.

The turbine rests upon three points of support which insures a firm seating at all points without undesirable stresses. The wheel-casing, diaphragms, bearing linings, and packing boxes are split horizontally for convenient inspection or removal of wheels. For high steam pressures and temperatures, the casing and other affected parts are made of steel. The turbine can be arranged to operate at steam pressures up to 400 pounds and steam temperatures up to 725 deg. Fahrenheit. These turbines are available in capacities of 5 to 700 horsepower at speeds from 1000 to 5000 r. p. m. and can be arranged for all ordinary steam conditions.

New Foote Gear Reducers

Foote Brothers Gear and Machine Company has recently placed on the market, a complete line of high grade, known as the 'Hygrade," worm gear reducers of the anti-friction bearing type. These machines are very compact, sturdy in construction, and the horse power capacity per pound of metal is very high. The Company has under preparation, a new twenty-four page catalog which will completely describe this line and will include tables, formulae and data of interest to engineers and designers concerned with power transmission problems.

New Incorporations

Buhrman Sand & Gravel Corp., $175,000. F. W. Buhrman, A. S. Bayles, H. S. Weller. (Filed by Weller & Rogers, Jamaica, N. Y.)

Sandrock Co., Phoenix, Ariz., R. C. Kaster, Pres.; Gates M. Fowler, V. P.; Henry W. Chambers, Sec.-Treas. Will begin immediately construction of plant to wash, screen, and grade sand and gravel.

Oregon-Idaho Lime Products Co., 417 Pacific Bldg., Portland, Ore., $1,000,000. C. E. Johnson, G. A. Cayot, A. F. Putman.

Lynchburg Marble & Granite Works, Inc., Lynchburg, Va. $15,000 to $50,000. C. G. Loving, Pres.; George G. Loving, Sec'y.; Charles M. Loving. To mine, quarry, manufacture and work marble, talc, slate and other minerals.

Woodbury Granite Co., Burlington, Vt. Absorbs all buildings and interests of Woodbury Granite Company of Hardwick. $250,000 pfd.; 7200 shares n. p. v. J. T. Smith, Pres., Burlington, Vt.

Silica Sand Co., San Antonio, Tex. $40,000. G. H. Piper, A. H. Piper, Harry Hatch.

Weaver-Blank Sand & Gravel Co., Wichita, Kans. $10,000. D. E. and R. W. Weaver, F. E. Blank. Will pump sand and gravel from Big Arkansas River at Fifteenth St.

Agricultural Lime Corp., Inc., Mark W. Cole, Dover, Dela. (Corp. Trust Co. of Dela.) $700,000. Limestone, rock, sand.

Equipment Corporation Will Be at Good Roads Show

The Equipment Corporation of America will occupy Booth number A-20 at the Good Roads Show and have as its exhibit the following products: Road roller, hoist, derrick, sheet steel piling, steam hammer, and clamshell bucket. Representatives of the company from Philadelphia, Pittsburgh and Chicago will be present at the show.

At 2:00 P. M. daily, busses will leave the booth for this company's Chicago Rebuilding plant where nearly a million dollars worth of construction equipment, either for rent or for sale, is on exhibition.

New Butler Bin Catalog

The Butler Bin Company will have ready for distribution January 10th at the Chicago Road Show a new sixty-eight page catalog devoted to its steel loading bins and aggregate measuring hoppers. This catalog is very complete in detail, profusely illustrated, and shows typical yard layouts and methods of handling coarse and fine aggregate.

There's an Army of 'em

Staso Milling Company

MANUFACTURING DIVISION

332 S. MICHIGAN AVE.
12 EAST 41st STREET

Poultney, Vermont

SUBJECT: Brookville Locomotive

Nov. 17, 1926.

Brookville Locomotive Co.,
Brookville,
Penna.

Gentlemen:

We wish to thank you for the very prompt service we received on our recent order for a four-ton Brookville Locomotive.

This machine was received at our Whiteford, Laryland, Plant within eight days after order was placed with you. We immediately put this locomotive into operation hauling four-yard cars on a quarry stripping job.

The other two Brookville Locomotives we purchased for our Hampton, New York, and Castleton, Vermont, Plants are still giving splendid service. One of these machines has been in almost daily operation for the past three years.

Very truly yours,
STASO MILLING COMPANY
Chas. G. Kett
General Superintendent.

Literally Hundreds of Satisfied Users

Read What the Staso Milling Company *Say* ⟶

We could not write any advertising copy that would demonstrate either our service or the quality and performance of BROOKVILLE GASOLINE LOCOMOTIVES more forceably than this unsolicited letter! "One locomotive delivered in Maryland eight days after the order was placed—Two others still giving splendid service—One—in almost daily service for the past three years"—THANKS, MR. KETT!

BROOKVILLE GASOLINE LOCOMOTIVES are built around dependable Ford and Fordson Units with parts obtainable at your local Service Station. They are powerful, speedy and economical both in first cost and operation. Their Big New Feature

THREE SPEEDS FORWARD
and
THREE SPEEDS REVERSE

Gives equal pulling power in both directions.

The Brookville line now includes ten models ranging from 1½ to 8 Tons with Draw Bar Pull of 750 to over 2400 Lbs.

Full descriptive literature and our engineering counsel on your requirements are yours for the asking.

BROOKVILLE LOCOMOTIVE CO. **Brookville, Pa.**

BROOKVILLE

GASOLINE LOCOMOTIVES